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September 6, 2016

Dennis McLerran, Administrator
Cami Grandinetti, Regional Superfund Remedial Cleanup Program Manager
Environmental Protection Agency, Region 10
ATTN: Harbor Comments
805 SW Broadway, Suite 500
Portland, OR 97205

RE: Port of Portland Comments on Portland Harbor Proposed Plan

Dear Dennis and Cami:

The Port of Portland (the "Port") welcomes the opportunity to comment on the Environmental Protection Agency's (EPA's) Proposed Plan (the "Proposed Plan") for the Portland Harbor Superfund Site (the "Harbor"). The Port is committed to a cleanup that protects the health of Portlanders and the environment and to finding the most cost-effective way to achieve it.

The attached comments offer constructive modifications to EPA's Harbor-wide framework that will reach the same long-term risk reduction as EPA's Proposed Plan, but will reduce risks sooner and at much lower cost. The Port's comments focus on how targeted adjustments would help move cleanup forward in two areas in the Harbor—Swan Island and Terminal 4. The Port demonstrates that equally protective, less costly solutions are available; that a site-specific approach to remedy selection, design, and action will achieve EPA's goals; and that, without making adjustments to the approach it took in the Proposed Plan, EPA risks issuing a Record of Decision (ROD) that cannot be implemented in a timely fashion because of major technical and legal deficiencies in EPA's site investigation, risk assessment, alternatives evaluation, and remedy selection.

The Port urges EPA's ROD to include the flexibility, accurate risk assessment, and risk management that are needed to enable equally protective, more efficient, and less costly cleanup solutions to emerge and be implemented in the Harbor. A successful cleanup requires a partnership between EPA, the affected community, and the potentially responsible parties—including local employers, utilities, and public entities—who must marshal the resources to carry forward this complex, cooperative effort. EPA's responsibility is not only to select a remedy but also to ensure that it can be implemented.

We hope that the attached comments will assist EPA in developing a ROD that puts Portland Harbor on the path to efficient implementation of a protective, cost effective remedy.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Curtis Robinhold'.

Curtis Robinhold
Deputy Executive Director

A handwritten signature in blue ink, appearing to read 'Jessica Hamilton'.

Jessica Hamilton
Lower Willamette Program

Executive Summary
Port of Portland Comments on Proposed Plan for Portland Harbor
(Environmental Protection Agency, June 8, 2016)

The Port of Portland (the "Port") welcomes the opportunity to comment on the Environmental Protection Agency's (EPA's) Proposed Plan (the "Proposed Plan") for the Portland Harbor Superfund Site (the "Harbor"). The Port is committed to a cleanup that protects the health of Portlanders and the environment and to finding the most cost-effective way to achieve it. The Port's comments offer constructive adjustments to EPA's Harbor-wide framework that will reach the same risk reduction as EPA's Proposed Plan but will reduce risks sooner and at much lower cost.

The Port has been engaged with the Superfund process in the Lower Willamette River for more than 15 years, dedicating significant resources to understanding the problem and taking early cleanup action. The Port's recommended adjustments are motivated by its deep history on the project and its commitment to finding an efficient path forward to cleanup. A successful cleanup requires a cooperative partnership between EPA, the affected community, and the potentially responsible parties (PRPs) who must carry forward this complex effort.

The Port's comments focus on how improved risk management and flexibility would affect two areas in the Harbor—Swan Island and Terminal 4—and would create a more streamlined path for the Port and other PRPs to secure the resources necessary to negotiate agreements with EPA and begin to work toward cleanup. The Port demonstrates that equally protective, less costly solutions are available; that a flexible, site-specific approach to remedy selection, design, and action will achieve EPA's goals; and that without making adjustments to the Proposed Plan, EPA risks issuing a Record of Decision (ROD) that cannot be implemented in a timely fashion because of major technical and legal deficiencies in EPA's site investigation, risk assessment, alternatives evaluation, and remedy selection.

Economic Significance of Successful Cleanup

Portland's "Working Harbor" is a vital economic driver for the region.¹ There are 30,000 direct jobs with an average salary of \$51,000 created by firms located within the working harbor and an additional 35,000 induced and indirect jobs. These are important jobs with lower barriers to entry. Further, a total of \$413 million in state and local tax revenue was generated by activity in the working harbor in FY 2015. These are significant contributions to the Portland and regional economy and the Port must be mindful of the impact of cleanup on the operating businesses in the Harbor.

The Port strives to promote economic development opportunities that benefit the economy and work for its neighbors and community. Listening to the community is one reason why the Port will not sponsor a confined disposal facility at Terminal 4.

The Harbor also represents an important economic opportunity for this region, presenting new prospects for investment, additional industrial land development, and potential new job creation. Many of these opportunities can be realized only if a cost-effective cleanup gets underway.

¹ The Port defines Portland's "Working Harbor" as the public and private marine terminals, industrial parks, and other commercial and warehousing businesses located along the Lower Willamette.

At a time when Portland and the region are facing many critical affordability issues, the costs of EPA's proposed cleanup plan are significant. EPA estimates its proposed cleanup will cost \$746 to \$811 million. Evaluation by the Lower Willamette Group (LWG) puts the cost of EPA's proposed cleanup closer to \$1.8 billion.² More importantly, it does not appear that the risk reduction benefits of the selected cleanup plan are proportional to its high costs.

Finding the most cost-effective way to achieve a protective cleanup is critical to the Port. Federal law prohibits the Port from using airport-related revenues to pay for non-airport expenses, such as Harbor cleanup. The Port therefore must rely on its marine and industrial revenues for cleanup, and its marine and industrial "general fund" faces significant challenges. To remain consistent with our public economic development mission, the Port cannot support a more costly cleanup when an alternative approach will be equally protective of human health and the environment.

The Port urges EPA to provide sufficient flexibility, accurate risk assessment, and risk management in its ROD to enable equally protective, less costly cleanup solutions to emerge during remedial design at locations across the Harbor.

Equally Protective, Less Costly Remedies—Swan Island, Terminal 4, and Harbor-wide

EPA's Proposed Plan lays out a uniform set of rules for Harbor-wide application. The Port's recommended adjustments recognize that the Harbor is very large, with distinct areas of contamination concentrated near the shore. Conditions vary at many individual locations within the 10-mile stretch of river, and the Harbor is dynamic. Any remedy should incorporate the flexibility needed to accommodate location-specific conditions and activities, including adjustments to remedial technologies.

1. Swan Island

Swan Island is a unique area within the Harbor, as EPA recognizes in its Proposed Plan. Swan Island's unique challenges and opportunities have prompted the Port to develop and advocate for an alternative, site-specific cleanup proposal.

The Swan Island proposal works within EPA's basic framework, but incorporates decision-making tools that allow for in-depth analysis of site-specific conditions and a mix of cleanup technologies that is tailored to those conditions. The proposal recognizes that the Swan Island Lagoon is uniquely suited to use of in-place technologies like capping, enhanced natural recovery, and treatment amendments such as activated carbon, as well as dredging. The alternative remedial approach can reduce the cost of cleanup at Swan Island by more than \$100 million while achieving equivalent risk reduction, maintaining compatibility with water-dependent uses of the Lagoon, and creating fewer short-term impacts to the community and the environment. By adopting this optimized alternative remedy, EPA can create the circumstances to bring a critical mass of PRPs to the table in a cooperative approach to cleanup in this area.

2. Terminal 4

At Terminal 4, the Port conducted substantial environmental cleanup in the 1990s and 2000s, including an "early action" in-water cleanup in 2008, which included significant dredging and

² LWG, EPA Cost Evaluation Memorandum (Aug. 29, 2016).

capping of contaminated sediment. The Port proposes additional cleanup to build on the early action and address the risks actually present at Terminal 4.

EPA's proposed remedy at Terminal 4 underscores the problems with a uniform, inflexible approach at a site as large and diverse as Portland Harbor. EPA's remedy here is designed to address a perceived Harbor-wide risk of contact with underwater sediment by fishing from a boat on a very frequent basis—260 days per year for 70 years. The reality of operations and lack of public access at Terminal 4 makes it nearly impossible to imagine someone fishing or using a beach at levels that could pose unacceptable risk. Access to the property is limited to such a degree that the risk EPA seeks to remedy does not exist.

An equally protective, less costly alternative would apply risk management principles and rely on the Port's site management and security protocols to prevent health risks related to human contact with contaminated sediment. Instead of focusing on a risk to human health that does not exist, the remedy would be designed to accurately characterize and address remaining risk to ecological health. This remedy approach could save tens of millions of dollars and achieve the same level of reduction in actual risks present at the site as the approach prescribed in the Proposed Plan.

3. Harbor-wide

The Port recommends that the ROD for all areas of the Harbor, including Swan Island and Terminal 4, be crafted in a way that remedy elements can be modified as location-specific conditions are examined and new data emerge. This approach is consistent with the Superfund law and EPA's own guidance. Among other things, EPA has said: "An iterative approach to site investigation and remedy implementation that provides the opportunity to respond to new information and conditions throughout the lifecycle of a site," is necessary "in remedy selection and implementation at large, complex [sites]."³ Additional data gathering and analysis of conditions at individual locations during the remedial design phase may reveal that strictly adhering to EPA's prescriptive approaches, such as inflexible technology assignment flowcharts and Harbor-wide risk assumptions, is not necessary to reach the cleanup objectives.

The ROD should incorporate significantly more flexibility into its approach so that cleanup can move forward in a protective, efficient manner in defined areas of the Harbor, based on location-specific conditions. To enable this, the ROD must describe an implementation framework that divides the site into operable units or uses another approach that is equally effective to allow cleanup to proceed to closure in some areas independent of others.

Overcoming Challenges to Implementation

The Port continues to highlight significant technical and legal deficiencies in EPA's approach to site investigation, risk assessment, alternatives evaluation, and remedy selection, both in its comments and those of the LWG. Continuing an overly uniform, prescriptive approach in the ROD will force EPA to confront the implementation challenges created by the Proposed Plan's deficiencies. The Port offers its recommendations as a way to help EPA move past these implementation challenges and increase the potential for a successful, timely cleanup in Portland Harbor.

³ U.S. Env'tl. Prot. Agency, *Superfund Remedial Program Review Action Plan* at 8 (Nov. 2013).

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I. Introduction

Portland deserves a Portland Harbor cleanup that is protective, cost effective, and efficient. A protective cleanup is one that protects people and the environment from risks caused by contaminated sediment at the Portland Harbor site. A cost-effective remedy is one that has costs proportional to its overall effectiveness in reducing risks. An efficient remedy is one that can be implemented promptly, avoid protracted administrative and legal delays, and reduce risks sooner.

Because the Environmental Protection Agency's (EPA's) June 8, 2016 Proposed Plan (the "Proposed Plan") uniformly and inflexibly applies the same approach to the diverse conditions with the 10-mile Portland Harbor site (the "Harbor"), the Proposed Plan will not accomplish these goals. Without adjustments, EPA risks losing momentum toward a timely cleanup and shifting focus toward contesting the key deficiencies in its remedy selection. While the deficiencies may be significant, they do not have to slow collective progress toward implementing a cleanup if EPA can make targeted improvements to increase flexibility, accurately characterize risk, and apply risk management principles in its final Record of Decision (ROD).

The Port of Portland (the "Port") is committed to working toward a protective, cost-effective cleanup that can be implemented efficiently. Portland's "Working Harbor"¹ represents a significant economic driver for the region. There are 30,000 direct jobs with an average salary of \$51,000 created by firms located within the working harbor and an additional 35,000 induced and indirect jobs. These are important jobs with lower barriers to entry. A total of \$413 million in state and local tax revenue was generated by activity in the working harbor in FY 2015. These are significant contributions to the Portland and regional economies and the Port must be mindful of the impact of cleanup on the operating businesses in the Harbor and on the ability to create new economic development opportunities.² The Port strives to promote economic development opportunities that benefit the economy and work for its neighbors and community. Listening to the community is one reason why the Port recently stated, and reiterates in Section III.C below, that it will not sponsor a confined disposal facility at Terminal 4.

¹ The Port defines Portland's "Working Harbor" as the public and private marine terminals, industrial parks, and other commercial and warehousing businesses located along the Lower Willamette. Details of the economic statistics that follow can be found in Appendix D2.

² For example, uncertainty created by the Superfund cleanup have prevented dredging of the navigation channel to federally authorized depths that could improve competitiveness and reduce navigational risks for existing marine traffic. EPA itself just released a study about the community benefits of a Superfund site, the Troutdale Reynolds Industrial Park, now owned by the Port. EPA noted that when a property is restored, "it can strengthen the local economy by supporting jobs, new businesses, tax revenues and spending." U.S. Env'tl. Prot. Agency, *Reuse and Benefits to the Community: Reynolds Metal Company Superfund Site* (Nov. 2015 v2), <https://semspub.epa.gov/work/10/100024770.pdf>.

The Port is also aware that local employers, taxpayers, and regulated utilities will be responsible for funding a significant portion of the cleanup. At a time when Portland and the region are facing many critical affordability issues, the costs of EPA's proposed cleanup plan are significant. EPA estimates its proposed cleanup will cost \$746 to \$811 million. Evaluation by the Lower Willamette Group puts the cost of EPA's proposed cleanup closer to \$1.8 billion,³ and calls into question whether the incremental benefits of EPA's cleanup plan are proportional to its high costs.⁴

For the Port, finding the most cost-effective way to achieve a protective cleanup is critical to our ability to balance cleanup responsibilities with our public mission. Federal law prohibits the Port from using airport-related revenues to pay for non-airport expenses, such as Harbor cleanup.⁵ Therefore, the Port's options for funding its fair share of the cleanup are limited to its marine and industrial general fund, which faces significant challenges. Elements of the Port's mission that are critical to the region's economic prosperity—like facilitating marine freight transportation and supporting industrial land supply for traded-sector development—are at stake. To move forward with other potentially responsible parties (PRPs) toward cleanup, the Port must find a way to fund its fair share of cleanup costs without jeopardizing the Port's ability to support marine, commercial, and industrial activity in the region. To remain consistent with our public economic development mission, the Port cannot support a more costly cleanup when an alternative approach will be equally protective of human health and the environment.

II. Equally Protective, Less Costly Solutions Are Available

The Port would like to find a way to partner with EPA and other PRPs to move forward with a protective, cost-effective cleanup in key areas of the Harbor. One way to overcome the challenge of moving forward despite significant deficiencies in EPA's Harbor-wide remedy development and selection is for EPA to acknowledge that a one-size-fits-all approach is not appropriate for the entire 10-mile stretch of the Harbor.

A successful ROD at a large, complex sediment site like Portland Harbor must contain flexibility with regard to the remedy approach, particularly where EPA's risk and remedy alternative evaluations contain significant levels of uncertainty. EPA guidance advocates the use of iterative, risk-based approaches to cleanup that retain flexibility to reevaluate site assumptions as new information is gathered. Targeted improvements to EPA's ROD should account for up-to-date, site-specific conditions and leave sufficient flexibility to enable the design of cost-effective remedial actions that can be implemented efficiently.⁶

³ LWG, EPA Cost Evaluation Memorandum (Aug. 29, 2016).

⁴ LWG comments also filed on September 6, 2016 ("LWG Comments"), Section V.

⁵ See 49 U.S.C. § 47107(b)(1); 47133(a).

⁶ To accomplish this, EPA should replace its technology assignment flowcharts with the ones offered by the Swan Island Group (see Appendix A) and the LWG (see LWG Comments, Section IV(A)).

By optimizing the remedy in certain areas in its Proposed Plan, EPA has begun to acknowledge that the Harbor is a varied environment. EPA's preferred Alternative I optimizes the remedy for certain distinct segments of the Harbor.⁷ In a few instances, EPA found that a more or less aggressive version of the standard remedy would meet EPA's goals, and adjusted its approach accordingly. EPA noted that "[f]urther adjustments could be made to Alternative I to meet [EPA's] goals, which would be finalized in the ROD."⁸ The Port's comments highlight two areas where EPA should take its examination of site-specific conditions further—Swan Island and Terminal 4.

The Port has focused on Swan Island and Terminal 4 for different reasons. The Port owns Terminal 4 and has been deeply involved in leading cleanup there. The significant in-water cleanup and upland source control work already accomplished by the Port are detailed in Appendix B. Swan Island, by contrast, is a large area with a complex history of ownership and operations, making allocation of potential liability uncertain and shared among many parties. Because of Swan Island's significance within the Harbor, the Port has focused on solutions there and has worked with a coalition of PRPs to develop the equally protective, cost effective, and implementable remedy approach detailed in Appendix A.

The alternative remedies the Port presents for Swan Island and Terminal 4 are concrete examples of how targeted adjustments and flexibility in the ROD can accomplish equally protective, less costly outcomes. EPA can create momentum toward cleanup by refining the ROD to accommodate these specific outcomes and offering a practical, flexible implementation framework that allows similar outcomes to emerge in other areas.

A. Swan Island Alternative Cleanup Proposal

The Swan Island area poses challenges—and offers opportunities—unlike any other area within the Harbor. EPA's Proposed Plan recognizes that Swan Island needs a unique approach, which has led the Port and other PRPs (the "Swan Island Group") to develop the detailed proposal outlined in Appendix A. The proposal works within EPA's framework, but recommends adjustments that allow the remedy to be better calibrated to the Swan Island area's unique conditions and the needs of its businesses, and able to achieve equivalent, permanent risk reduction at less cost than EPA's preferred remedy. The broad support for this approach among Swan Island Group's PRPs underscores its feasibility. Under the Proposed Plan approach and EPA's cost estimates, remedy construction in the Swan Island area would cost approximately \$236 million⁹ (with realistic cost estimates, likely \$443 million¹⁰) and would be

⁷ These distinct segments of the Harbor are called "sediment decision units," or SDUs, in EPA's Proposed Plan and draft Final Feasibility Study (FS).

⁸ Proposed Plan at 77.

⁹ Formational Environmental, Capital Cost Estimates in the Swan Island and River Mile 4.5E (Terminal 4) Sediment Decision Unit for EPA's Alternative I (Aug. 31, 2016).

¹⁰ Anchor QEA, Planning Level Remedial Costs Assuming EPA's Feasibility Study Remedial Technology Approach (Aug. 31, 2016).

exceedingly difficult to implement. The recommended adjustments offer a path forward that is equally protective and, under the right circumstances, implementable by a group of PRPs.

These comments summarize the alternative remedy proposal and why EPA should adopt the adjustments necessary to enable it. The full technical details and rationale for the proposal can be found in Appendix A.

1. Introduction to Swan Island

The Swan Island area delineated in EPA's plan is very large, covering 120 acres mostly within Swan Island Lagoon. Swan Island Lagoon is a constructed, blind-end industrial slip and berthing area surrounded on three sides by a heavily industrialized area. The Lagoon is isolated from the main stem of the river and lacks significant natural river flow. Water depths are relatively shallow at the back of the Lagoon (less than 20 feet) and generally are 30 feet or deeper throughout the rest of the Lagoon where the ship repair yard, marine berths, and associated access areas are located. At the mouth of the Lagoon, in the deeper area where it meets the main channel of the river, is a shipyard originally constructed by the United States.

Swan Island and the surrounding area are home to 150 diverse businesses, including the newly constructed headquarters for Daimler Trucks and the largest commercial ship repair facility on the west coast, operated by Vigor Industrial. Swan Island also has a rich and diverse history; among other things, the United States commissioned construction of the shipyard to build tankers for World War II and later to repair and scrap war ships. After the intense war effort and many decades of industrial activity, a variety of contaminants have come to rest in the sediment within Swan Island Lagoon. The overall cleanup approach is driven by polychlorinated biphenyls (PCBs), which are one of the main contaminants of concern and are used to identify areas for remediation that contain other contaminants as well.¹¹

2. Site-specific adjustments to EPA's assumptions provide the foundation for an alternative remedy

All of EPA's remedial alternatives for Swan Island include large areas of dredging and minor areas of capping (under dock structures) and then cover the entire remainder of the area with enhanced natural recovery (ENR) consisting of a one-foot thick sand layer. The ENR layer may be amended with activated carbon, which is a treatment that significantly reduces the extent to which contaminants can be absorbed into the food chain.

The main difference among EPA's alternatives is the amount of dredging versus ENR, with the cost of each alternative increasing in rough proportion to the amount of dredging. The footprints

¹¹ To organize remedial alternatives within "sediment management areas," EPA identified "focused [contaminants of concern]" that represent the greatest spatial extent of contamination and correspond with the majority of the risk identified in the baseline risk assessments. Proposed Plan at 25; U.S. Env'tl. Prot. Agency, *Portland Harbor Feasibility Study Report* at Section 3.4.1.1 (2015) ("2015 Draft FS"). PCBs are one of those focused contaminants. The focused contaminants are used to establish boundaries for the distribution of other contaminants identified in the baseline risk assessments.

for dredging in EPA's proposed remedy are defined by the remedial action level (RAL), which is the level of contaminant concentration that triggers cleanup action. Alternative I includes a RAL of 200 ppb for PCBs, which results in roughly 52 acres of dredging and 72 acres of ENR.¹² Using EPA's cost assumptions, the Port estimates that construction of Alternative I would cost approximately \$236 million,¹³ using EPA's estimates, and likely \$443 million with more realistic estimates.¹⁴

EPA's approach to Swan Island is based on several key assumptions that are unsupported and lead the Proposed Plan to a far more costly remedy than is necessary to reach the same level of protection for human health and the environment. The significant problems with each of these assumptions are detailed in Appendix A1 and Appendix C. Adjusting these key assumptions leads to more use of in-place remedial technologies, which the alternative remedy approach would allow to be tailored to specific conditions within the Lagoon.

- Key Site-Specific Conditions. EPA's remedy for Swan Island is dredging-intensive because the harbor-wide technology assignment flowcharts default to dredging for all areas designated as having navigational depth requirements. Appendix A presents key site-specific information demonstrating that a mix of remedial technologies could be applied effectively within the areas of Swan Island identified as requiring active remediation. These key considerations are:¹⁵
 - Future Maintenance Dredge (FMD) Designation. Updated information, confirmed by all existing water-dependent users of the Lagoon, demonstrates that areas subject to future maintenance dredging in the Lagoon are much smaller than EPA assumed and that the FMD footprint should be revised, along with navigation depth requirements assumed within the FMD footprint.
 - Water Depths Compared to Navigation Depth Requirements. Water depths in much of the Lagoon already meet or exceed required navigation depths and do not require ongoing maintenance dredging because of the very low sediment deposition rate. Furthermore, the existing sediment bottom surface is sufficiently deep that in-place technologies could be utilized in much of the Lagoon without impacting current or future navigation depth requirements or being adversely affected by navigation activities.

¹² Appendix A1, Section 2 provides more detail on EPA's proposed remedy.

¹³ Formation Environmental, Capital Cost Estimates in the Swan Island and River Mile 4.5E (Terminal 4) Sediment Decision Unit for EPA's Alternative I (Aug. 31, 2016).

¹⁴ Anchor QEA, Planning Level Remedial Costs Assuming EPA's Feasibility Study Remedial Technology Approach (Aug. 31, 2016).

¹⁵ Appendix A, Section 2 provides more detail on each of these key conditions on which EPA should incorporate site-specific information.

- Stable Sediments. Multiple factors presented in Appendix A indicate the stable nature of sediments in the Swan Island environment, as a result of being isolated from the mainstem of the Lower Willamette River. EPA recognizes this characteristic of the Lagoon and acknowledges that sediment stability is a key factor in EPA's national sediment remediation guidance. The physical stability of sediments allows for permanence of in-place technologies like ENR, capping, or *in situ* treatment. Analysis conducted to date indicates the potential effect of vessel propeller wash on sediment is shallow (less than a foot), is highly localized, and can be effectively managed through remedial design.¹⁶
- Surface Sediment and Fish Tissue Concentrations. Data from recent sampling efforts from various parties indicate the potential for lower PCB concentrations in surface sediment than assumed in EPA's remedy. This trend is supported by PCB concentrations measured in smallmouth bass from Swan Island as part of a fish tissue sampling event requested by EPA in 2012. And while additional investigations will be conducted to confirm these lower chemical concentrations, this data indicate the potential viability of natural recovery processes should be further assessed in remedial design.
- Principal Threat Waste. EPA's dredging-intensive approach is also based on its designation of PCBs in concentrations of 200 ppb or above as "principal threat waste" (PTW). The PTW designation triggers either removal or stringent capping requirements to meet a statutory "preference for treatment." EPA's designation of PTW over large geographic areas with relatively low concentrations of contaminants is significantly out of step with its own guidance and precedent at many other sediment sites.¹⁷ However, Appendix A shows that there are alternative methods for addressing PTW, without changing the threshold for PTW designation, by using various in-place remedial technologies to address PTW in Swan Island Lagoon.
- Effectiveness Evaluation. EPA concluded that dredging sediments with PCB concentrations above 200 ppb and applying ENR everywhere else is needed to achieve remedial goals. However, in an unexplained departure from its prior approach and from accepted technical principles, EPA did not quantify the long-term effectiveness of ENR, with or without activated carbon. The Port regards EPA's change of position and failure to quantify risk reduction from ENR and activated carbon as a significant error.¹⁸ ENR is

¹⁶ For instance, in localized areas where studies determine that propeller wash could disturb sediment more deeply, armoring could be used.

¹⁷ The Port's many continuing objections to EPA's PTW approach are described in Appendix A1 and Appendix C. See Appendix A1, Section 4; Appendix C, Section II(b)(iii). See also LWG Comments, Section II.

¹⁸ The Port elaborates on this error in Appendix A1 and Appendix C. See Appendix A1, Section 5; Appendix C, Section II(b)(ii).

an active remedy technology that has been shown to reduce risks, and activated carbon significantly improves the performance of ENR. Appendix A quantifies the effectiveness of all elements of the alternative proposal, including ENR/activated carbon.

- Potential for Sediment Recontamination. One foundational element that will have to be addressed is what can be achieved in Swan Island Lagoon under any remedial action. The optimized alternative remedy approach, like EPA's Proposed Plan, assumes that any ongoing sources of contamination will be controlled before implementing an in-water remedy. Yet, even with ongoing sources controlled, the urban and industrial environment that drains to Swan Island Lagoon is likely to continue to contribute chemicals to the Lagoon. In that context, Swan Island Lagoon's bathtub-like environment creates a unique risk of sediment recontamination. Whatever remedy EPA selects, the Lagoon will not settle at EPA's designated background-based remedial goal of 9 ppb PCB, nor perhaps even the 20 ppb PCB that the LWG has projected as the Harbor-wide average equilibrium concentration. Based on detailed site-specific investigation, EPA will have to reevaluate what is achievable for off-channel industrial areas, no matter what remedy is selected.¹⁹

The details discussed in Appendix A show that the alternative remedy proposal for Swan Island can achieve an equally protective, less costly outcome. The proposal would correct deficiencies with EPA's approach by adjusting certain key assumptions and modifying the technology assignment flowcharts (and the associated multi-criteria decision matrix) to enable the remedy design to consider site-specific facts and analysis. The revised technology assignments would allow the final remedy design to tailor the application of dredging and in-place technologies to a better understanding of site conditions, producing a remedial alternative that is equally protective, but with fewer negative impacts.

The Swan Island optimized remedy approach, described in greater detail in Section II.A.3 below, attempts to work within EPA's framework and is an effort to move forward despite continuing disagreement on some foundational elements of EPA's remedy selection, like PTW and what is achievable for off-channel industrial areas.

3. Alternative Swan Island remedy approach can achieve equally protective, permanent risk reduction at significantly lower cost

EPA needs to make adjustments in its ROD to incorporate the up-to-date and detailed analysis of site-specific conditions at Swan Island described above. Adjustments should make the remedy approach more flexible and allow the ultimate remedy to achieve equivalent risk reduction at significantly lower cost, while remaining compatible with the physical environment and current and future uses.

¹⁹ Requiring a cleanup to meet physically unachievable background-based PRGs would be arbitrary and capricious. See Appendix A1, Section 3; Appendix C, Section II(b)(i). See also LWG Comments, Sections I(C)(1) and III.

As further described in Appendix A, the Swan Island Group's recommended approach is to adjust EPA's technology assignment flowcharts and maintain flexibility in the remedial design process for a series of site-specific investigations resulting in an optimized alternative remedy that provides a better balance of the remedy selection balancing criteria that EPA is required to consider. This is an implementable strategy that is not dependent on EPA changing its PTW threshold or its RALs (the level of contaminant concentration that defines the area in which active remediation is required). In general, the recommended remedy approach would involve the following:

- Apply a mix of remedial technologies within the RAL footprint and to address PTW.²⁰ Incorporating current and future waterfront uses, required navigation depths and other site-specific factors in combination with adjustments to technology assignment flowcharts, will result in an optimized assignment of technologies within the areas EPA designated for active remediation. The additional remedial design investigations will further refine and inform the final cleanup design.
- Apply ENR or monitored natural recovery (MNR) in the remainder of Swan Island to further reduce exposure and risk from PCBs and other contaminants. In areas where surface sediment concentrations are lower than the RALs and not designated as PTW, application of ENR or MNR would be evaluated based on remedial design investigations.
- Monitor performance and recontamination potential to help establish long-term remedial goals. Monitoring programs will be necessary to measure performance of the remedy and to help determine what is achievable at Swan Island.

Adjustments to the technology assignment flowchart and maintaining flexibility in the remedial design process proposed in EPA's ROD is briefly described here, and in detail in Appendix A.

a. Adjust technology assignment flowcharts to incorporate more flexibility for a mix of remedial technologies

EPA should adopt a Swan Island-specific technology assignment flowchart, recognizing that the area's unique qualities enable greater flexibility in applying in-place remedial technologies for effective, long-term risk reduction within the area defined by the RAL footprint.

The proposed technology assignment approach (described and depicted in Appendix A, Section 3.1 and Figure 4) would make the following key adjustments to EPA's technology assignment approach:

- Within the RAL footprint and inside the FMD area, indicate that dredging is required only if needed to achieve an adequate depth (i.e., three feet) below navigational requirements

²⁰ Under EPA's approach in the Proposed Plan, the RAL for PCBs and the threshold for PTW designation of PCBs are both 200 ppb.

to allow use of an in-place technology that will be determined by following the intermediate portion of the flowchart.

- For technology assignment within the intermediate portion of the flowchart (applicable both to areas not within the FMD area *and* to areas within the FMD area that are three or more feet below required navigation depth), indicate that ENR with treatment amendments such as activated carbon can be used to address contamination above the RAL and to treat PTW in areas that do not require armoring (i.e., if site investigation shows that absence of propeller wash impacts and other hydrological conditions support ENR with treatment amendments as a permanent remedy).
- In areas that are outside both the RAL footprint and the PTW designation, indicate that monitored natural recovery (MNR) can be considered as an alternative to ENR, if warranted based on investigation of local conditions (i.e., localized sedimentation rates and concentrations in discrete areas).
- In areas of PTW designation that are outside the RAL footprint, indicate application of ENR with treatment amendments such as activated carbon. This is consistent with EPA's text related to Swan Island, but had not previously been included in the Harbor-wide technology assignment flowcharts.

Application of this adjusted flowchart would allow sufficient flexibility to apply a mix of remedial technologies within Swan Island to account for the unique conditions. Consistent with the above changes, EPA's multi-criteria decision matrix²¹ should clarify that cap/cover technologies can be implemented in areas of Swan Island that EPA identified as subject to propeller wash, if site-specific studies demonstrate that water depth is adequate to resist erosive forces from vessels.

b. Maintain flexibility in the remedial design process based on a series of site-specific investigations

The Swan Island Group recognizes EPA's uncertainty about the permanence and effectiveness of certain in-place technologies for Swan Island. The optimized remedy manages this uncertainty within EPA's framework by tailoring technology assignments to reflect up-to-date information and analysis presented in Appendix A, but also leaving flexibility for ultimate technology assignment based on a series of site-specific investigations during remedial design. Those investigations would provide a more appropriate level of up-to-date information and analysis to demonstrate permanence and effectiveness of technology assignments. The investigations (described in Appendix A, Section 3.2) could include data collection, sediment stability analysis, studies of protectiveness and long-term effectiveness of ENR with activated carbon or other amendments in areas of higher sediment concentrations, and evaluation of source control and achievable remedial goals.²²

²¹ FS Figure 3.4-16.

²² See Appendix A, Section 3.2.

c. Benefits of conceptual optimized remedy alternative

To depict a remedial alternative that could result from the adjusted decision tree approach (at an appropriate level of detail for the FS and ROD), the Swan Island Group applied the decision trees based on chemical concentration data that EPA used in the FS, existing data and analysis relating to sediment stability and propeller wash, and information gathered by the Swan Island Group about navigation depth needs. The conceptual alternative remedy that results is depicted in Appendix A, Figure 5.

That alternative remedy is equally protective of human health and the environment. Evaluating all active elements of the remedy, Appendix A estimates that the alternative remedy achieves a post-construction sediment concentration of 14 ppb PCBs, equal to EPA's 2015 Draft FS assessment for Alternative E.²³ In addition to the measure of effective risk reduction based on chemical concentrations in sediment, Appendix A shows that activated carbon added to ENR can further reduce bioaccumulation of PCBs by 60 to 90 percent. The current sediment stability analysis demonstrates that ENR can be permanent in the Lagoon, which will be further confirmed during remedial design.

In addition to equivalent long-term effectiveness in reducing risk, the alternative remedy also significantly improves upon EPA's approach in terms of short-term effectiveness, implementability, and cost—all criteria that EPA is legally required to balance.²⁴ The proposed alternative is estimated to take approximately half as long to construct, reducing impacts to operating businesses and the aquatic environment. Using EPA's cost-estimating assumptions, the estimated construction cost for the alternative remedy is \$114 million²⁵, compared to \$236 million for EPA's remedy. Given that the conceptual alternative remedy is equally effective in protecting human health and the environment, the approach represents a substantially better balance of the required criteria.

4. How EPA's ROD can enable an equally protective, less costly Swan Island remedy

In sum, the specific adjustments and flexibility needed in the ROD to enable a broadly supported, equally-protective alternative remedy for Swan Island are:

²³ Appendix A, Section 4.1, and Appendix A1, Section 5, explain that EPA's 2016 estimate of post-construction sediment concentration for Alternative I is 48 ppb, but this analysis ignores without rationale the risk reduction provided by ENR and activated carbon, which EPA had considered in 2015. When all elements of the remedy are included in the effectiveness analysis, the proposed alternative and EPA's Alternative I both achieve results that achieve maximum risk reduction—meaning that they are both estimated to reach concentrations below the achievable long-term equilibrium range for an off-channel environment (i.e., 20 ppb or less).

²⁴ See Appendix A, Sections 4.4 through 4.6.

²⁵ Formation Environmental, Capital Cost Estimates in the Swan Island and River Mile 4.5E (Terminal 4) Sediment Decision Unit for Port's Optimized Alternatives (Aug. 31, 2016).

(1) Incorporate up-to-date information such as FMD designation and required navigational depths for the Swan Island area and acknowledge the existing analysis such as the stable nature of sediments;

(2) adjust the technology assignment flowcharts to enable greater application of in-place remedy technologies in this uniquely stable sediment environment, if warranted by site-specific investigation; and

(3) maintain flexibility in the remedial design process based on a series of site-specific investigations that will further inform and better manage key assumptions and uncertainties identified by EPA.

The conceptual remedy alternative that results from applying these adjustments to the EPA framework, based on up-to-date site-specific information and analysis (to be confirmed after the ROD), would achieve equivalent risk reduction at significantly lower cost and would be compatible with current and future uses, as well as the physical environment, of the Lagoon.

Without a change to the Proposed Plan approach, cleanup in the Swan Island area will be exceedingly difficult to implement, because its high costs are out of proportion to its level of protectiveness and because the assumptions underlying the remedy are technically and legally deficient. With the recommended adjustments, EPA can create a path to enable parties to begin to marshal the significant level of resources and cooperation needed to accomplish a successful cleanup.

B. Terminal 4 Alternative Cleanup Proposal

The Port has already conducted significant cleanup at Terminal 4 and is committed to additional cleanup that reduces actual risks remaining at the site. However, because the Proposed Plan does not acknowledge site-specific conditions controlling public access to Terminal 4, EPA overstates the risks present at Terminal 4 and proposes a remedy whose costs are significantly out of proportion to reduction in actual risks. EPA's preferred alternative requires \$32 to \$62 million dollars of additional dredging and capping²⁶ to address a risk—highly frequent direct contact with underwater sediment—that is already prevented at Terminal 4 by current and future uses and the Port's security protocols.

The Port's proposed remedy, described in Appendix B, would rely on site management and security protocols to ensure that human health risks from direct contact with sediment remain absent at Terminal 4 into the future, as they are today. Additional active remedy would focus on site-specific identification of risk to benthic organisms (e.g., worms, clams) and localized areas of PCB contamination, if those areas are confirmed by up-to-date sampling data. This remedy

²⁶ The Port estimates that EPA's Proposed Plan would require approximately 105,000 more cubic yards of dredging and 1.5 more acres of capping at a cost estimated at \$32 to \$62 million. Appendix B, Section 3.

would cost tens of millions of dollars less to achieve the same level of actual risk reduction as EPA's remedy.²⁷

1. Introduction to Terminal 4 and Port's early cleanup actions

Terminal 4 is a marine terminal owned by the Port and leased for marine business operations. Terminal 4 has two off-channel slips. Slip 1 is inactive, but Slip 3 houses the most active ship berth in the Harbor, with a long-term lease for international export of soda ash. On average, a ship is in Slip 3 close to 300 days per year. No public access to Terminal 4 is permitted, and the Port maintains a 24-hour security operation to enforce facility security protocols implemented pursuant to federal law.²⁸

The primary focus of remediation at Terminal 4 has been contamination from polycyclic aromatic hydrocarbons (PAHs) in Slip 3, which came from historical offloading of pencil pitch (a byproduct from the distillation of coal tar) and fuel oil leakage from a supply pipeline that transported locomotive fuel oil from Slip 3 to a tank farm on the bluff overlooking Terminal 4. PAHs are not a primary focus at Slip 1.

The Port has already reduced risks with significant in-water and upland cleanup at Terminal 4. From the 1980s through the 2000s, the Port removed more than 50,000 cubic yards of contaminated sediment from Slip 3.²⁹ In the early 2000s, the Port became the first party in Portland Harbor to voluntarily take on an in-water "early action" under EPA oversight, removing another 13,000 cubic yards of the most highly contaminated sediment, constructing caps and sand covers, and stabilizing the shoreline. In addition, the Port has conducted upland cleanup at Terminal 4, including fully controlling a groundwater plume (contrary to the Proposed Plan's depiction of the groundwater plume as an ongoing source).³⁰ When the Port conducted maintenance dredging in Slip 3 in 2013, removing another 5,500 cubic yards, much of the material removed was clean enough to qualify for open-water placement—demonstrating the success of the early cleanup.³¹

2. EPA should rely on current and future site uses and security protocols, which prevent direct-contact risks to human health

EPA's ROD should reflect the realistic risk of direct contact with contaminated sediments and base risk-management decisions on that reality. Risks from human direct contact with sediment

²⁷ Appendix B, Section 3.3.1, estimates that 80 to 90 percent of the \$32 to \$62 million cost to implement EPA's remedy is associated with reducing inapplicable human health direct-contact risks. Thus, applying the risk management principles described here could save between \$20 to \$50 million, though a small portion of those savings would be applied to remediation to address any remaining benthic risk.

²⁸ Details related to Terminal 4 operations and security are in Appendix B2.

²⁹ See Appendix B, Section 2.3.

³⁰ See Appendix B, Section 2.2.

³¹ See Appendix B, Section 2.3.

do not exist in places that people cannot access. At Terminal 4, EPA can and should rely upon the Port's site management and security protocols to ensure that risks to human health based on direct contact, which do not exist today, will remain absent in the future.

a. Harbor-wide direct-contact exposure assumption

In the Baseline Human Health Risk Assessment (BHHRA), EPA established generic exposure scenarios which it used to evaluate the risk to humans from particular contaminants. The only human exposure scenario driving EPA's proposed cleanup of PAHs at Terminal 4 is direct contact with sediment.³²

Because there is no public beach access at Terminal 4, the only possible direct contact with sediment is from the water. EPA evaluated various categories of fishers and divers on a Harbor-wide basis, setting generic values for factors like the number of days and years of exposure and the frequency and amount of sediment contact.³³

In its most conservative fishing scenario, EPA assumed that a person would fish at Terminal 4 for 260 days per year every year for 70 years and, during every single visit, would cover his or her hands and forearms with sediment and ingest sediment when pulling up fishing lines or anchors.³⁴ This assumed exposure appears to drive the PAH cleanup requirement that the Proposed Plan applied to Terminal 4.³⁵

EPA must adjust its Harbor-wide approach to direct-contact human health risk and make risk management decisions based on site-specific considerations. Basing remedy selection on an assumption that direct contact with sediment is possible everywhere in the Harbor, without consideration of variations in conditions and land use, leads to a Terminal 4 cleanup requirement that is unsupported by the facts and unrelated to real risk reduction.

³² The level of PAH contamination at Terminal 4 is below the level that EPA assumes would cause fish consumption risk. See Appendix B, Table 1. Nonetheless, the Port agrees with LWG's conclusion that EPA has not made a valid linkage between PAH contamination and fish consumption risk. LWG Comments, Section I(C)(1).

³³ See Appendix B, Section 4.

³⁴ See Appendix B, Section 4.2.

³⁵ EPA's Proposed Plan is not clear on how people are presumed to come into contact with sediment at Terminal 4—i.e., from the beach or from the water. See Appendix B, at 12. In the BHHRA, EPA recognized that beach exposure was not present at Terminal 4 and examined direct contact from fishing from a boat, and appeared to carry that assumption into the 2016 FS. The Proposed Plan could be interpreted to establish an inappropriate Harbor-wide rule that all PAHs—wherever they are and regardless of whether or how people may contact them—must be cleaned up to levels that would allow beach use. Regardless of whether EPA now intends for the beach use (12 ug/kg) or fishing (106 ug/kg) scenarios to set the cleanup goal for PAHs at Terminal 4, neither should be applied to require remediation because site conditions prevent meaningful direct contact.

b. Direct-contact exposure inapplicable at Terminal 4

Current and future marine terminal uses at Terminal 4 make fishing (and beach access from fishing boats) highly improbable. Slip 3 houses the most active ship berth in Portland Harbor. To encounter significant PAH contamination, a fisher would have to navigate into Slip 3 or the adjacent bay, next to a soda ash loading operation that is active nearly 300 days per year. With extremely large, ocean-going vessels moving in and out every few days, navigational safety for fishing boats is an issue. Signs reading "NO ANCHORING, GROUNDING OR SHORE TIE-UPS" are in place to protect areas of engineered cap and bank stabilization that the Port constructed in its early action. This is an inherently unlikely place for sustained fishing.³⁶

Observations from long-time Port employees with responsibility for Terminal 4 confirm this conclusion. Over the past decade, such employees report seeing fewer than 10 fishing boats enter Slip 3 and the adjacent bay, where the majority of the PAH contamination is found, which amounts to less than one occurrence per year.

In addition, Port security protocols prevent sustained fishing in Terminal 4 slips. The Port maintains a dedicated security operation and Facility Security Plan (FSP) developed and implemented pursuant to U.S. Coast Guard regulations authorized by the Maritime Transportation Security Act (MTSA).³⁷ Congress adopted the MTSA in 2002, and by approximately 2006–2007, the Port had implemented its current FSP approach. Since then, Port security officers have followed a standard practice with respect to unauthorized vessels entering the off-channel slips, described in Appendix B2 and formalized in Patrol Orders.³⁸ Port security officers are instructed to direct or request that unauthorized vessels depart, depending on their location in the facility and vessel movement. The Port collaborates with the U.S. Coast Guard and local law enforcement, as needed and available, to enforce its Facility Security Plan. The effectiveness of these practices is reflected in the observations of Port employees that fishers rarely access and use Terminal 4.

At most, fishing in the off-channel slips and bay at Terminal 4 consists of isolated, *de minimis* instances—on the order of a few examples per decade at Slip 3 and a few examples per year in Slip 1 (where PAH contamination is not a concern). Isolated, infrequent fishing in Terminal 4 simply does not pose a risk to human health. The Port's early cleanup has reduced

³⁶ See Appendix B2.

³⁷ 33 C.F.R. § 105.400; 46 U.S.C § 70103.

³⁸ The Port's security protocols have become more stringent since the Port fully implemented its current approach to the MTSA, which makes conditions at the site different than they were when the Port and EPA evaluated the site for the early action in 2005 and early 2006. Statements in the Engineering Evaluation/Cost Analysis (May 2005) and EPA Action Memorandum (May 2006) regarding transient, trespasser, and recreational fisher access to the site are outdated and incorrect. The EE/CA, in general, did not contain a robust risk assessment (see Action Memorandum at 9) and multiple documents associated with the Early Action indicate EPA's intention that cleanup levels for Terminal 4 be set in the ROD. See, e.g., Phase II Final Design Status Report (April 2010), at 14.

concentrations of PAH at Terminal 4 significantly, and additional active remedy to address benthic risk (discussed below) will further reduce the PAH levels at the site. With current PAH levels and EPA's very conservative exposure assumptions, the same person could safely fish in Terminal 4 six times per year for 70 years (420 lifetime fishing days in Terminal 4).

If more reasonable assumptions for the amount of contact with sediment while fishing were considered, as an example, the same person could fish in Terminal 4 approximately every other week for 30 years (750 lifetime fishing days in Terminal 4) without experiencing unacceptable health risks.³⁹ Thus, EPA does not need to expect the Port's site management and security protocols will eliminate every single instance of fishing in order to conclude that relying on them is an effective and cost-effective way to ensure that unacceptable human health risks do not exist at Terminal 4, now or in the future, and reach a prudent risk management decision.

c. Risk management decision

The Port requests that EPA make a site-specific risk management decision in the ROD that human direct-contact risk is inapplicable to remedy selection and design at Terminal 4. The Port's site management and security protocols constitute governmental controls which EPA can recognize as existing institutional controls (ICs), as they impose "restrictions on land or resource use using the authority of a government entity."⁴⁰

As a government entity and long-term owner of Terminal 4, the Port is uniquely situated to maintain and enforce the site management and security protocols necessary to ensure that direct-contact human health risk remains absent. To the extent EPA believes it is necessary to further formalize the controls, the Port would be willing to discuss with EPA additional ICs to ensure protectiveness and permanence. For example, additional ICs could be triggered upon any future change to the relevant site uses and security protocols that enables significantly increased levels of public access to Terminal 4 that could increase potential health risks. Under current conditions, however, additional active remedy at Terminal 4 is not warranted to address direct-contact human health risk.

3. EPA should change its benthic risk analysis and provide flexibility for site-specific conditions to determine cleanup design

With no realistic human health risk associated with direct-contact exposure in Terminal 4, the primary driver for assessing PAH cleanup is risk to benthic organisms. The Port's early action significantly reduced benthic risk. In the Proposed Plan, EPA calls for additional cleanup based on its analysis of benthic risk. However, there are two reasons why additional PAH cleanup at

³⁹ See Appendix B, Section 4.2.

⁴⁰ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, EPA 540-R-09-001, OSWER 9355.0-89, *Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites* at 4 (Dec. 2012).

Terminal 4 should be based on direct toxicity measurements, rather than on EPA's 2016 benthic risk analysis.⁴¹

First, any remaining PAH contamination in Terminal 4 that may be associated with pencil pitch will behave differently from other, more common forms of PAH contamination (e.g., fuel oil). The chemical properties of PAH from pencil pitch make it significantly less bioavailable than other PAHs—meaning, pencil pitch is significantly less toxic to benthic organisms than the same concentration of PAH from other more common sources in the Harbor. Therefore, Harbor-wide chemical criteria and models will not reliably identify benthic risk from all PAHs at Terminal 4.

Second, EPA's 2016 analysis for analyzing benthic risk is a significant and technically indefensible departure from the well-vetted Comprehensive Benthic Risk Area (CBRA) approach that EPA and LWG developed together, based on the multiple lines of evidence presented and evaluated in the EPA-approved ecological risk assessment.⁴² The depiction of benthic risk area at Terminal 4 in EPA's model is completely different from the results from the CBRA as well as site-specific testing at Terminal 4, both of which suggest some potential remaining risk in Slip 3—but in completely different places than EPA's model predicts.

Fortunately, there is a simple solution: EPA's ROD should state clearly that parties may use site-specific toxicity testing to verify model outcomes and design the final remedial action, based on methods and details that EPA agrees during remedial design will produce equally protective results. The Port joins the LWG in recommending that EPA return to the CBRA approach, with site-specific toxicity testing as an available confirmation tool in pre-remedial design.

In addition, EPA must account for site-specific conditions to ensure that elements of the early action that the Port has already constructed (i.e., caps, shoreline stabilization) are not disturbed or destroyed. The final remedy should be compatible with the early action and accommodate other site conditions, like steep slopes and terminal operations.⁴³

4. How EPA's ROD can enable an equally protective, less costly Terminal 4 remedy

In sum, the adjustments to the preferred alternative and flexibility needed in EPA's ROD to achieve an equally protective, less costly alternative for Terminal 4 are to:

- recognize that human direct-contact exposure must be examined on a site-specific basis and rely on the Port's site management and security protocols to prevent human health risk from direct contact with PAHs at Terminal 4;

⁴¹ See Appendix B, Section 5.

⁴² See Appendix B, Section 5.1; Appendix C, Section II(b)(v). See also LWG Comments, Section I(A).

⁴³ See Appendix B, Sections 6 and 7.1.

- allow benthic risk areas to be identified based on the well-vetted CBRA approach and verified using site-specific toxicity testing; and
- maintain flexibility to address site-specific conditions in remedial design.

These changes can allow cleanup to proceed at Terminal 4 without requiring an overly prescriptive remedy based on generic, Harbor-wide risk assumptions that are not supported by site-specific facts.

III. A Flexible, Site-Specific Approach to Remedial Design and Action Is Needed to Support Implementation

EPA should adopt an implementation framework that helps create the right set of circumstances for groups of PRPs to move forward with consent decrees in defined areas of the river. Operable units (OUs) are the simplest and most effective way to do this, and are well supported by EPA guidance and practice at other sites. Short of establishing OUs, EPA should state in the ROD how it will achieve an equally effective alternative implementation framework.

Particularly at a large, complex sediment site where EPA's risk and remedy evaluations contain significant levels of uncertainty, EPA's implementation framework should make use of tools for flexibility recommended in EPA guidance. EPA guidance advocates the use of iterative, adaptive, or phased approaches to cleanup that retain flexibility to test hypotheses and conclusions and reevaluate site assumptions as new information is gathered. The most protective, cost-effective remedy may vary across the Harbor according to differences in the driving chemical of concern, the exposures that actually occur, the cleanup levels that can be achieved, the compatibility of remedial technologies with current and future land uses and the physical environment, and the viability of effective, long-term management practices and institutional controls.

To transition to a successful ROD, EPA must begin to incorporate the many implementation-focused mechanisms found in EPA's own guidance and its past practice at large sediment sites. If EPA waits until after the ROD to address issues like effective site division and remedy design flexibility (discussed in subsections III.A and III.B below), then EPA will contribute to more delay and uncertainty in Portland Harbor.

Subsection III.C below addresses disposal options, where maintaining flexibility is paramount, because sponsoring a confined disposal facility at Terminal 4 is no longer the right decision for the Port.

A. Site Division as the Organizational Framework for Cleanup

Separating Portland Harbor into multiple geographic units would facilitate a more effective and timely remediation and risk reduction effort. OUs are the most commonly accepted method for the agency to accomplish this because they provide sufficient certainty to parties who are willing to move forward with consent decrees in defined areas of the river. The OU approach is

documented in guidance and used at complex sites like the Harbor.⁴⁴ Important objectives would be served by enabling cleanup to move forward under an OU structure, including:

- allowing EPA to work with parties in certain areas to efficiently move forward to cleanup and closure of liability for defined areas;
- enabling a phased approach;
- enabling enforcement in areas that are not making progress toward consent decrees, without jeopardizing cooperative progress in other areas;
- effectively sharing oversight with state regulators, including enabling state regulators to take a lead role in units where they have significant oversight history and expertise; and
- paving the way for alternative remedy approaches where unique conditions exist in a discrete geographic area.

What matters is that the ROD establish an approach to cleanup implementation and site management that achieves these important objectives.⁴⁵ EPA's reluctance to establish OUs is puzzling, especially given EPA's approach at other sites and its movement toward optimizing its remedy to reflect varying site conditions. Moving forward without explaining how it will provide an alternative way to accomplish the above objectives would be a missed opportunity for EPA to play its required leadership role in site cleanup. EPA is responsible not only for selecting a remedy but also for ensuring it can be implemented effectively.

B. Flexible Remedy Design Based on Up-to-Date, Site-Specific Analysis

When viewed as a single undifferentiated site, Portland Harbor appears extraordinarily complex, with its array of chemicals, sources, and physical environments. Developing a single plan to clean up the entire site requires simplifying assumptions that have the unintended consequence of magnifying uncertainties and disparities among the varied areas of the Harbor. However, if the ROD were to incorporate an OU-based approach along with a flexible process to accommodate site-specific conditions, the result would be a reduction in complexity, and correspondingly, a much more efficient implementation phase.⁴⁶

EPA's guidance supports this approach. EPA guidance provides ample solutions to deal with the analytical gaps in remedy evaluation, to acknowledge the uncertainty and complexity of large sediment sites, and to confirm that some iterative approaches will be necessary to reach

⁴⁴ See more detailed discussion in Appendix C, Section III(a); see also LWG Comments, Section VI.

⁴⁵ The LWG comments include a conceptual framework for how OUs could be used to help achieve these goals. See LWG comments, Section VI.

⁴⁶ See more detailed discussion in Appendix C, Section III.

optimal cleanup results. EPA guidance recognizes that contaminated sediment sites are different from and more complex than “typical” Superfund sites and therefore more flexible approaches are required. Risk-management principles and iterative approaches discussed in EPA guidance promote smart decision-making and the ability to learn from information as it is gathered to achieve an efficient and effective remedial solution.

These types of approaches can help ensure that EPA’s remedy is able to respond to data collected after issuing decision documents. For example, natural recovery is a known ongoing process occurring within Portland Harbor. The ROD should allow for significant changes to elements of its remedy based on new data. “An iterative approach to site investigation and remedy implementation that provides the opportunity to respond to new information and conditions throughout the lifecycle of a site,” is necessary “in remedy selection and implementation at large, complex [sites].”⁴⁷

EPA should modify its technology assignment framework to allow its remedy to stay responsive to up-to-date, site-specific data collected and analyzed after the ROD is issued. Appendix A proposes adjustments that allow a Swan Island-specific version of EPA’s technology assignment flowcharts to be responsive to information about site-specific conditions—whether site-specific information presented in public comment that EPA did not previously consider, new information gathered after the ROD is issued, or pilot studies conducted in remedial design.

Going a step further, the LWG proposes a remedial technology assignment flowchart for Harbor-wide application that would replace EPA’s decision tree approach.⁴⁸ Its adoption in the ROD would significantly improve the ability of EPA’s remedy to accommodate site-specific conditions into remedy technology selection and design. By using these flexible decision-making frameworks, EPA can achieve certainty that important effectiveness and permanence considerations will determine remedy technology selection and design without forcing an overly conservative, prescriptive approach.

Without significant changes like these or a clear statement that its technology assignment decision trees are merely a starting framework for decision-making during remedial design, EPA’s ROD is too prescriptive and uniform to be implemented successfully. At Terminal 4, for example, rigid application of the technology flowcharts without up-to-date data would lead to destroying already constructed elements of the early action remedy (e.g., dredging up a previously constructed cap at the head of Slip 3) and choosing technology assignments not appropriate for site conditions (e.g., dredging steep slopes), as discussed in Appendix B. The Port assumes that EPA’s intention is not to ignore these types of considerations and decisions normally made in remedial design. EPA guidance states that the discussion of the selected remedy “should mention that the remedy may change somewhat as a result of the remedial

⁴⁷ U.S. Env’tl. Prot. Agency, *Superfund Remedial Program Review Action Plan* at 8 (Nov. 2013).

⁴⁸ LWG Comments, Section IV(A).

design and construction processes."⁴⁹ To be clear about its intention to adhere to these principles, EPA should modify the technology assignment flowcharts to make clear that flexibility is anticipated.

A significant, visible statement in the ROD of EPA's commitment to flexibility in the remedy approach is critical to encouraging parties to move forward cooperatively with additional data collection and remedial design. Without assurance that meaningful new information and analysis can be incorporated into site-specific remedy approaches, it will be difficult to persuade PRPs to work cooperatively with EPA to take even the first steps toward remedy implementation.

C. Alternative Options for Disposal

EPA has identified two disposal scenarios, one using only off-site landfills and another selecting a confined disposal facility (CDF) at Terminal 4 for a portion of sediment disposal. The Port encourages EPA to retain optionality in the ROD to incorporate other disposal mechanisms not specifically presented for evaluation at the time of the FS and Proposed Plan.

This is critical because the Port has concluded that a Terminal 4 CDF is no longer the right decision for the Port. The Port continues to agree with EPA that the Terminal 4 CDF would be safe for people and the environment. However, given uncertainties in factors like cost, design, acceptance criteria, and performance criteria,⁵⁰ the financial viability of the Terminal 4 CDF relative to other options appears marginal and could deteriorate if less expensive landfill or other disposal options materialize.

Moreover, a CDF would be a significant, permanent commitment at Terminal 4, imposing long-term responsibilities on the Port and straining the Port's relationship with neighboring communities who have consistently opposed the CDF. For all these reasons, the Port has concluded that the CDF is not an appropriate use of limited Port resources.

The Port requests that EPA steer disposal options in the ROD away from the Terminal 4 CDF and be prepared to adjust the Port's early action to eliminate it. Instead, the ROD should remain open to a variety of protective, cost-effective disposal options that the market may deliver in response to the Harbor cleanup, including the potential for temporary transload facilities at the Port's Terminal 4 or Terminal 2.

⁴⁹ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, EPA 540-R-98-031, *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* at 6-40 (July 1999).

⁵⁰ Examples of such uncertainties include the following: EPA's Proposed Plan omitted several relevant costs from its analysis (e.g., oversight, insurance, submerged land acquisition). EPA's assumptions for mitigation costs were unclear, because the assumed acreage did not match the prior Terminal 4 CDF 60 percent design documents. Also, the FS and Proposed Plan did not clearly confirm whether the CDF would be required to carry forward certain design contingencies that materially affect the CDF's cost. Finally, the source requirements for the noncontaminated cover material were not clear.

IV. Technical and Legal Deficiencies Challenge Implementation, Particularly if EPA Takes an Overly Prescriptive, Uniform Approach in the ROD

Remedy adjustments like those described above can point Portland Harbor toward the cleanup that Portland deserves—protective, cost effective, and efficient. However, if EPA intends to stay with an overly prescriptive and uniform remedy approach, it will need to address many significant technical and legal deficiencies before issuing a ROD. Deficiencies in EPA's analysis and remedy selection weaken the foundation for the cohesive, cooperative action that will be required for a successful Harbor cleanup, because they make it difficult for PRPs to view EPA's cleanup plan as a reasoned, scientifically supported approach that complies with legal requirements.

In a June 22 letter to EPA,⁵¹ the Port detailed its continued concern with unrealistic goals that are not achievable or tied to substantiated risks, the absence of credible comparative evaluation of different alternatives for achieving risk reduction, and the lack of flexibility for remedy implementation. The Port elaborates on some of those key deficiencies in Appendix C, and LWG Comments provide more detail.

The following paragraphs summarize, in simple terms, how technical and legal deficiencies in EPA's approach touch on each of the required elements of remedy selection:

- *EPA must accurately identify the human health and environmental risks at the site.*⁵²
However, the Proposed Plan:
 - Discarded years of work to identify benthic ecological risk areas using technically supportable methods, and introduced a new and unsupported method for analyzing Harbor-wide benthic risk.⁵³
 - Changed EPA's method for measuring the average contaminant concentrations that exist at the site, which results in initial conditions being inconsistent with the Remedial Investigation and EPA's own baseline risk assessments, makes current risks appear more significant than warranted by site data, and as a result biases the alternatives analysis toward more aggressive cleanup alternatives without increases in protectiveness.⁵⁴

⁵¹ Appendix D1.

⁵² See Office of Emergency and Remedial Response, U.S. Env'tl. Prot. Agency, EPA/540/1-89/002, *Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A)* at 1-1 (Dec. 1989); Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, OSWER 9285.7-25, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* at 1-3 (June 1997).

⁵³ Appendix C, Section II(b)(v); Appendix B; LWG Comments, Section I(A).

⁵⁴ LWG Comments, Section I(C)(2)(b).

- *EPA must direct cleanup only where contamination contributes to identified risks and risk management principles support action.*⁵⁵ However, the Proposed Plan:
 - Applied the same cleanup goals for direct-contact risk to all areas of the Harbor regardless of whether direct contact with sediment is realistic in particular areas of the river, and did not apply risk management principles to adjust the remedy approach where direct contact does not occur.⁵⁶
- *EPA must set required cleanup levels based on what the site remedy can realistically achieve, given inputs from outside the site.*⁵⁷ However, the Proposed Plan:
 - Continued to reject evidence that upstream and watershed conditions will make it impossible for any sediment cleanup in Portland Harbor to achieve EPA's background-based cleanup goal for PCBs.⁵⁸
 - Did not address uncertainty about whether it is possible for unique, off-channel industrial settings like Swan Island Lagoon to reach the Harbor-wide average background level.⁵⁹
 - Declined to waive state water quality and groundwater requirements, despite evidence that a Harbor sediment cleanup alone cannot achieve them.⁶⁰
- *EPA must acknowledge that the different remedial alternatives it evaluates are all protective of human health and the environment.*⁶¹ However, the Proposed Plan:
 - Rejected Alternatives B and D as not protective, based on flawed ecological risk analysis and leading to a result that is itself flawed, since each remedial alternative EPA considers in a feasibility study is legally required to be protective.⁶²
- *EPA must objectively and quantitatively compare how effective different remedial alternatives are at reducing risk.*⁶³ However, the Proposed Plan:

⁵⁵ See generally Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, OSWER Directive 9285.6-08, *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites* (Feb. 12, 2002).

⁵⁶ Appendix C, Section II(b)(iv); LWG Comments, Section I(C)(1).

⁵⁷ See Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, OSWER 9285.6-07P, *Role of Background in the CERCLA Cleanup Program* at 7 (April 26, 2002).

⁵⁸ Appendix C, Section II(b)(i) ; LWG Comments, Section I(C)(2)(c).

⁵⁹ Appendix C, Section II(b)(i), III(b)(ii).

⁶⁰ LWG Comments, Section I(B).

⁶¹ See Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, EPA 540-R-98-031, *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* at 1-5 (1999) ("Preparing Proposed Plan Guidance").

⁶² Appendix C, Section II(b)(v); LWG Comments, Section I(A).

⁶³ Preparing Proposed Plan Guidance at 1-5.

- Provided no credible explanation of how EPA's preferred remedy achieves risk reduction or attains cleanup goals in a substantially shorter time than other alternatives.⁶⁴ In fact, EPA's conclusions in the FS, consistent with past analysis from the LWG, assume that all alternatives will achieve comparable levels of risk reduction within similar time frames.⁶⁵
- Calculated no quantifiable risk reduction from either application of enhanced natural recovery or treatment by activated carbon, providing no explanation for reversing the position it took on enhanced natural recovery in the 2015 Draft FS.⁶⁶
- Designated large areas of relatively low level contaminants as "principal threat waste," in conflict with guidance and precedent, skewing the remedy toward removal and treatment rather than equally effective, less costly technologies.⁶⁷
- Relied on prescriptive technology scoring and decision trees without indicating flexibility for site specific opportunities to make use of alternative technology assignments for equally protective results.⁶⁸
- *EPA must balance short-term, long-term, and cost considerations to select a preferred remedial approach that is cost-effective.*⁶⁹ However, the Proposed Plan:
 - Understated the cost and time for remedy implementation, providing estimates that are approximately half of what multiple, independent analyses have concluded.⁷⁰ Inaccurate cost estimates are a problem not only for EPA's analysis of alternatives, but also for parties who must make informed business decisions about participating in cleanup.
 - Minimally addressed the negative impacts to human health, the environment, and the surrounding communities that will occur during construction, leading to little credit for alternatives that can achieve equivalent long-term risk reduction with fewer short-term impacts.⁷¹
 - Did not compare the cost-effectiveness of all alternatives, and did not quantitatively examine the relative cost compared with overall effectiveness in reducing risk for any alternatives.⁷²

⁶⁴ Appendix C, Section II(c)(i)(1); LWG Comments, Section IV(D) and V(C).

⁶⁵ See FS at 4-6; LWG Comments, Section III.

⁶⁶ Appendix C, Section II(b)(ii); Appendix A1.

⁶⁷ Appendix C, Section II(b)(iii); LWG Comments, Section II.

⁶⁸ Appendix C, Section III; LWG Comments, Section IV(A).

⁶⁹ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, OSWER 9355.0-27FS, *A Guide to Selecting Superfund Remedial Actions* at 3 (April 1990) ("Selecting Remedy Guidance"); 40 C.F.R. § 300.430(f)(1).

⁷⁰ Appendix C, Section II(c)(i)(5); LWG Comments, Section IV(F).

⁷¹ Appendix C, Section II(c)(i)(3); LWG Comments, Section IV(C).

⁷² Appendix C, Section II(c)(ii); LWG Comments, Section V.

EPA need not eliminate all uncertainty from its evaluation nor examine every site-specific condition in order to reach a defensible remedy selection. However, EPA must demonstrate that it has taken a reasoned approach. Choosing Alternative I over less aggressive alternatives because it may be more likely to achieve remedial goals, with no meaningful analysis to support this conclusion, is not a reasoned approach. This approach to dealing with uncertainty might have been acceptable and consistent with an iterative, risk-management approach if EPA had selected the least aggressive alternative for initial action, but EPA did not.

To justify selection of a prescriptive and uniform final remedy based on Alternative I, EPA would need to address the issues summarized above and provide a transparent analysis of whether increasingly resource-intensive alternatives deliver meaningfully better results. Specifically, EPA would need to:

- consider how sensitive its conclusions are to its chosen starting point—i.e., to the assumption about current concentrations;
- compare, on a consistent scale, when alternatives will achieve comparable levels of risk reduction and/or meet the cleanup goals;
- communicate incremental risk reduction from one alternative to the next in terms that are transparent and accessible to the public and relevant to the remedial action objectives—e.g., by reference to the increased amount of resident fish that can be consumed safely; and
- demonstrate that the selected remedy is cost-effective, in that its overall effectiveness is proportional to its costs.

Without a reasoned, quantitative basis to compare rates and levels of risk reduction, trade-offs among remedies cannot be evaluated in the manner that is legally required. As it stands, EPA's Proposed Plan selects an overly prescriptive and uniform preferred cleanup alternative that does not achieve clear or certain benefits over less costly alternatives, but will cost local employers, taxpayers, and utility customers hundreds of millions of dollars—likely close to a billion dollars—more.

For fish consumption, the primary risk that is driving cleanup at the site, the incremental benefits of Alternative I are not apparent.⁷³ All of the alternatives will improve the number of resident fish that various populations can safely consume. Dredging-intensive alternatives, like EPA's Alternative I, do not clearly improve fish consumption outcomes as compared with less dredging-intensive alternatives.

⁷³ See generally LWG Comments, Sections I(C) and V(C).

All alternatives are likely to reach the same point of equilibrium over time,⁷⁴ and no sediment cleanup of Portland Harbor (not even the most aggressive Alternative H, whose bank-to-bank dredging EPA concluded is not implementable⁷⁵) is capable of eliminating all health-based limitations on fish consumption.⁷⁶ In short, each alternative for remediation will produce comparable risk reductions on a Harbor-wide basis, and none of those risk reductions can be achieved until EPA creates the conditions for cleanup to move forward.

The most important thing EPA can do to make significant risk reductions a reality in Portland Harbor is to create better conditions for cohesive, cooperative action. EPA can improve momentum toward cleanup by making targeted adjustments and maintaining flexibility in the remedy approach in the ROD. Should EPA proceed with its overly prescriptive, uniform, and poorly supported approach, its ROD will need to cure these technical deficiencies up front or risk protracted administrative and legal delays. Staying with the current approach will push Portland Harbor farther away from the time when significant risk reductions can be achieved.

V. Moving Forward to Cleanup

EPA should seek to enable the Port and other parties to get to the business of cleaning up the Harbor by adopting the recommendations identified here. These comments show that with adjustments, EPA can work within the broader framework of its FS and Proposed Plan and still issue a timely ROD that is more capable of encouraging performance than its current approach. The focus of the ROD and post-ROD actions should be to create a flexible framework that enables parties to begin to gather information that will allow them to design and implement cleanup actions that are protective and cost-effective, rather than focusing on the deficiencies and legal vulnerabilities of the Proposed Plan. Incorporating flexibility to enable alternative solutions that will work within EPA's framework, like the solutions described for Swan Island and Terminal 4, is a way for EPA to create momentum toward cleanup.

⁷⁴ *Id.*; see also LWG Comments, Section I(B)(2)(c).

⁷⁵ Proposed Plan at 37 and 45.

⁷⁶ The current Oregon Health Authority Willamette River main stem mercury-based advisory for resident fish (12 meals/year for vulnerable populations and 48 meals/year for everyone else) applies from the Columbia River to Eugene, and will not be affected by the Superfund cleanup. In April 2016, the Oregon Health Authority recommended limiting consumption of bass anywhere in the state (24 meals/year for vulnerable populations and 72 meals/year for everyone else), because of elevated mercury levels. See Oregon Health Authority, Advisories and Guidelines, <https://public.health.oregon.gov/HealthyEnvironments/Recreation/FishConsumption/Pages/fishadvisories.aspx#willamette>, accessed Aug. 14, 2016.

APPENDIX A

September 6, 2016

ATTN: Harbor Comments

U.S. Environmental Protection Agency, Region 10
805 SW Broadway, Suite 500
Portland, OR 97205

Dear EPA Region 10:

We are a group of Portland Harbor Superfund Site (Site) PRPs interested in the Swan Island Lagoon portion of the Site (the "Swan Island Group"), all of whom are members of the Participation and Common Interest Group (PCIG), that have come together to comment on and propose targeted adjustments to the Environmental Protection Agency's (EPA) remedial approach for the Swan Island sediment decision unit (SDU). As described in EPA's June 8, 2016 Proposed Plan for the Site (and its June 8, 2016 Feasibility Study), the Swan Island SDU is unique and complex among the Site's SDUs. Consequently, we propose in the enclosed comments modifications that optimize the approach described in EPA's Proposed Plan in order to provide equivalent, but more efficient risk reduction in the Swan Island SDU.

Specifically, our comments ask EPA to incorporate key specific conditions of the Swan Island Lagoon and adopt a more flexible, Swan Island SDU-specific technology assignment flowchart that allows for a wider range of remedial technologies to be considered in the areas within the SI SDU that are identified for active remediation. Our approach produces an optimized remedial alternative that is equally protective of human health and the environment as EPA's Alternative I, but is better optimized to site conditions and current and future water-dependent uses, less resource-intensive, and less disruptive to Swan Island Lagoon stakeholders and neighbors.

Together, we urge EPA to adopt the Swan Island Group's optimized remedial alternative approach in its final Record of Decision.¹

Sincerely,

Port of Portland

Daimler Trucks North America LLC

BAE Systems San Diego Ship Repair, Inc.

Cascade General, Inc.

The Marine Group, LLC

Lockheed Martin Corporation

Atlantic Richfield Company

CIL&D, LLC

Exxon Mobil Corporation (including its
subsidiary and affiliate companies)

KSC Recovery, Inc.

¹ Support for this optimized remedial approach, and any facts or conclusions contained therein, is not an admission of liability and will not be used to allocate or recover costs related to the Site.

Portland Harbor Superfund Site
Swan Island Sediment Decision Unit Optimized Remedial Alternative

Executive Summary

The following comments are submitted by the Port of Portland, Daimler Trucks North America LLC, Cascade General, Inc., BAE Systems San Diego Ship Repair, Inc., The Marine Group, LLC, Exxon Mobil Corporation (including its subsidiary and affiliate companies), Atlantic Richfield Company, Lockheed Martin Corporation, CIL&D, LLC, and KSC Recovery, Inc. (collectively, the “Swan Island Group”¹) with respect to the Draft Final Feasibility Study (FS) and Proposed Plan (PP) for the Portland Harbor Superfund Site (“Site”) issued on June 8, 2016 by Region 10 of the United States Environmental Protection Agency (EPA)². These comments concern the Swan Island Sediment Decision Unit (SI SDU), a distinct and unique part of the Site. EPA acknowledges some of the SI SDU’s singular qualities in the FS/PP in the remedial technology assignments for the SI SDU. While the FS/PP allows for optimization of remedies at some SDUs, and site-specific technology assignments for the SI SDU, the Swan Island Group believes that additional flexibility in applying the remedial technologies set forth in the FS/PP is appropriate for the SI SDU.

The comments identify key site-specific conditions and refinements, such as up-to-date Future Maintenance Dredging (FMD) requirements, in support of SI SDU-specific adjustments to EPA’s remedial technology assignment flowcharts. The comments also address certain inconsistencies in the FS. The proposed adjustments retain and enhance the flexibility of EPA’s technology assignments for the SI SDU, incorporate up-to-date data and information, and promote effective and efficient implementation of National Contingency Plan (NCP)-compliant remedial action. These adjustments will optimize the remedial alternative selected for the SI SDU, so are referred to as an “optimized” approach.

We agree with EPA that the SI SDU bears unique features and conditions. We believe the flexible framework noted earlier should provide for consideration and utilization of updated information, such additional information to be further developed during the remedial design phase. This updated information could come from multiple lines of evidence, including pilot studies, geotechnical investigations, additional sediment stability and propeller wash analyses

¹ Support for this optimized remedial approach, and any facts or conclusions contained therein, is not an admission of liability and will not be used to allocate or recover costs related to the Site.

² This memorandum is a joint product of Formation Environmental, Geosyntec Consultants, and Pacific Groundwater Group, as well as the signatory parties.

for capping/ Enhanced Natural Recovery (ENR)/ Monitored natural Recovery (MNR) technologies, and fish tissue and sediment sampling to determine the concentrations of chemicals of concern (COCs) throughout the SI SDU.

To effectively incorporate this updated information and optimize the remedial alternative for the SI SDU, EPA should make the following refinements in the FS/PP and, in the Record of Decision (ROD) when it is issued:

- Allow for inclusion and consideration of the following information and key site-specific conditions, such as:
 - up-to-date FMD designations and required navigational depths (based upon information provided by stakeholders operating within the SI SDU);
 - current bathymetry data in comparison to required navigation depths;
 - evidence of sediment stability in the lagoon;
 - up-to-date surface sediment polychlorinated biphenyl (PCB) concentration data;
 - effective in-place containment or treatment of Principal Threat Waste (PTW)³; and
 - practical source control measures.
- Add a single unified SI SDU-specific technology assignment flowchart that includes the FMD, intermediate, and shallow technology assignments.
- Consistent with the above changes, the multi-criteria decision matrix at FS Figure 3.4-16 should make clear that cap/cover technologies (e.g., Engineered Cap, Broadcast Granular Activated Carbon (GAC), ENR) can be implemented in FS-defined propeller wash areas within the SI SDU, when site investigation shows that the navigational depth is adequate to resist erosive forces from such propeller wash.

As described in the following comments, such flexibility for the SI SDU will be built into the unified technology flowchart and an optimized remedial alternative approach would be implemented during the remedial design and remedial action phase based on a series of site-specific investigations.

³ Members of the Swan Island Group disagree with EPA's proposed designation of PTW, as explained in separate comments on the PP. Although the SI SDU optimized approach is not dependent on a change in EPA's threshold for designating PTW, the members of the Swan Island Group note for the record their position that EPA has incorrectly designated PTW. Similarly, the SI SDU optimized approach is not dependent on a change in EPA's proposed remedial action levels. Separate comments being submitted to EPA may nonetheless articulate technical and legal reasons why EPA should change them. Such comments do not, however, lessen the commitment of the Swan Island Group to the approach outlined in this memo.

This memo provides a conceptual depiction of the proposed optimized remedial alternative using updated information and compares it to EPA's Alternative I based on criteria specified in the NCP for CERCLA remedies. This analysis concludes that the optimized remedial alternative is equally protective of human health and the environment as Alternative I as presented in the FS/PP, with the optimized approach being more cost effective, more quickly and easily implemented, and less disruptive to current Swan Island Lagoon stakeholders, including neighboring communities.

1.0 Introduction

These comments describe an optimized approach for remedial action in the SI SDU at the Site. The entire SI SDU is located outside of the main channel of the Willamette River and is mostly contained in Swan Island Lagoon, a blind-end industrial slip and berthing area. Taking into account updated information on the required navigational depth in the lagoon, current bathymetry data versus navigation depth needs, considering the lagoon's acknowledged sediment stability, and additional lines of evidence with respect to surface PCB sediment and fish tissue data, and factoring in source control, we propose certain adjustments to the remedial technology flowcharts in the FS for the SI SDU. These requested changes are consistent with EPA's overall remedy logic and appropriate for the unique conditions in SI SDU and will help to correct inconsistencies in the FS report. We also believe that there should be flexibility in the application of remedial technologies during remedial design in order to address uncertainties with the Conceptual Site Model for the SI SDU. Such adjustments in the remedial technology flowcharts and flexibility in the application of remedial technologies will result in an optimized, location-specific remedial approach for the SI SDU that is NCP-compliant and provides at least equal environmental protection in a shorter time-frame.

The size and complexity of the Site have made it challenging to characterize and analyze. During the Remedial Investigation/Feasibility Study process, there was a tendency for unique areas to be sidelined given the necessity of understanding the Site as a whole. This was the case for the SI SDU, where a comprehensive evaluation is particularly important. The Site's complexity has also led to some inconsistencies and ambiguities between the text in the FS, the remedial technology assignment flowcharts presented in the FS figures, and the PP.

For example, EPA recognizes that Swan Island Lagoon requires special consideration in the assignment of remedial technologies (e.g., PP pg 32 and pg 61; FS pg ES-18), and as found in EPA's ENR evaluation of Swan Island Lagoon included in FS Appendix D (EPA 2016b). Indeed, the FS subdivides the Site into four river segments in order to evaluate attainment of the Remedial Action Objectives (RAOs), with one segment being the SI SDU (FS pg 4-2), and it states that the "subdivisions will allow for a more precise analysis of risk reduction for each alternative." However, EPA has not undertaken such a precise analysis. As a result, certain remedial technologies, such as MNR for the SI SDU, have been improperly screened out of consideration.

We agree with EPA that Swan Island Lagoon requires a more precise analysis of risk reduction. While the Site-wide screening-level FS process is not well-suited for location-specific

optimization, this goal can be achieved at the SI SDU through further study and evaluation during the remedial design phase. We also recognize that some uncertainty exists with respect to the permanence and effectiveness of certain in-place remedial technologies. However, this uncertainty can be managed within EPA's framework through careful tailoring of technology assignments using the data and analysis presented here, with further refinements achieved through pre-remedial design studies and the remedial design itself.

Accordingly, in our comments we ask EPA to make certain adjustments in the ROD so as to retain and enhance the flexibility of remedial technology assignments that will be applied to the SI SDU. The requested changes to EPA's technology assignment decision flowcharts will enable future optimization of remedial technologies based on multiple criteria that include pre-remedial design studies, geotechnical considerations, detailed sediment stability and propeller wash analyses, and updated sediment and fish tissue concentration sampling data. Some key benefits of optimizing remedial technologies at the SI SDU include:

- achieving long-term risk reduction equivalent to EPA's PP, while attaining significant risk reductions over a shorter time period;
- improving cost-effectiveness and promoting efficient/sustainable use of resources, which will in turn generate broader support for implementing EPA's selected remedy;
- maintaining compatibility with water-dependent uses and navigation depths;
- addressing EPA's preference for removal of designated PTW⁴;
- generating additional reductions in short term environmental and health impacts; and
- minimizing disruption to businesses that depend on access to the SI SDU.

Section 2 of this document describes the SI SDU-specific key issues, data, and assumptions that are appropriate for updating and refinement. Section 3 describes the recommended SI SDU-specific remedial technology assignment flowchart. A conceptual depiction of the optimized remedy approach using updated data is also provided in Section 3. In Section 4, the optimized remedial alternative is compared to EPA's preferred Alternative I based on criteria specified in the NCP for CERCLA remedial actions. This analysis of the SI SDU optimized approach demonstrates that it is equally, and potentially more, protective, as well as more implementable, than EPA's Alternative I.

⁴ The Proposed Plan includes three categories of PTW, which EPA describes as "highly toxic PTW," "PTW source material," and "PTW that cannot be reliably contained." Per the PP, PTW within SI SDU is identified only as "highly toxic PTW."

2.0 The Case for Optimizing the SI SDU Remedial Alternative

In order to optimize the remedial design of SDUs, it is necessary to have an updated and improved understanding of their site-specific conditions. For the SI SDU, the most important factors to be considered are current and future land use and navigation needs in FMD areas, updated bathymetry data, and information regarding sediment stability properties, contaminant distribution and concentrations, and source control. The following summaries cover key issues in each of these areas for the SI SDU.

2.1 Updated Designation of Future Maintenance Dredge Areas and Navigational Depth Requirements

The FS/PP adopted general assumptions about future navigation uses and the need for maintenance dredging in FMD areas. The FMD areas for the Site were developed by seven parties following a 2008 vessel use survey (LWG FS 2012). EPA was not able to review that survey, but cited the need for more specificity about future harbor operations, with that evaluation to occur in the remedial design stage (FS pg 3-10 and Appendix C).

Specifically, the FS assumed that maintenance dredging would be needed to maintain navigation depths in all navigation areas:

SMAs within the federally authorized navigation channel or designated as FMD are assigned dredging as a technology due to minimum water depth requirements, the placement of thin sand layers, in-situ treatment amendments, and conventional or reactive caps because stand-alone technologies above the established navigation dredge depth are considered incompatible with current and future waterway uses.

(EPA 2016b pg 3-10).

The Swan Island Group has obtained more specific information about current and future navigation depth requirements in the SI SDU through contacts with entities that rely on Swan Island Lagoon for water-dependent uses (see Attachment A). As this information makes clear, the navigation uses and depth requirements (Figure 1) differ substantially from the assumptions made in the FS and PP and demonstrate that very little ongoing navigation maintenance dredging will be necessary. Given the updated information, the following changes to the assumptions about navigation depth requirements for the SI SDU should be made:

1. Removal of the FMD designation for the head of the Swan Island Lagoon past shipyard Berth 305 and for the mouth of the lagoon outside of the SI SDU.
2. Removal of the FMD designation near the SI Shipyard Ballast Water Treatment Plant bank slope.
3. Updating of navigation depth requirements as noted on Figure 1.

This more accurate FMD information should be incorporated into a revised FS and the ROD for the Site. Details will be updated during the remedial design phase, including the navigational needs of north shore business owners where shallower depths than currently shown may be sufficient to meet ongoing navigation requirements.

2.2 Comparison of Current Bathymetry Data to Navigation Depth Requirements

Bathymetry from recent surveys in the SI SDU shows that current depths in a large portion of the area designated by EPA for dredging in Alternative I are at or greater than the navigation requirements (Figure 2). Further, the existing sediment surface is sufficiently deep that in-place technologies such as capping, ENR, or MNR could be utilized in much of the lagoon without exceeding target navigation depths for current and future uses or being adversely affected by navigation activities. In some discrete areas along specific berths, limited dredging may be needed to allow capping or placement of ENR layers if the depth of contaminated sediment were to exceed 3 feet below the mudline or on the basis of other site specific factors (e.g., geotechnical considerations, or structural offset requirements).

EPA has cited concerns that FMD could disrupt in-place remedial technologies such as caps. However, as noted by EPA in the FS, sediment deposition rates in Swan Island Lagoon are low. In fact, the last time that dredging was performed in the central portion of the lagoon for the express purpose of maintaining the depth was in the 1950s (see Attachment B). Other dredging occurred between 1961 and 1973, but it was primarily associated with removing material stored in the lagoon after being dredged from the Federal Navigation Channel. In addition, some localized maintenance dredging has occurred in specific berths adjacent to the Swan Island or Mock's Landing shoreline where most ship repair activity occurs. As can be seen in Attachment B, Table 1, the last maintenance dredging to occur in the lagoon was in 1986 at Berths 306, 307, and 308, with a only small amount of material (1,200 cubic yards) being removed.

The lack of maintenance dredging was not due to the absence of an entity actively managing the lagoon depths. From 1975 to 2000, the Port held a permit from the U.S. Army Corps of Engineers and Oregon Department of State Lands to conduct maintenance dredging as needed (State of Oregon, Department of State Lands, 1975-2000 Material Removal Permit No. 2080). The permit allowed for maintaining the central part of the lagoon at -30 ft. Columbia River Datum, but no dredging was necessary due to lack of significant sediment deposition.

Hydrodynamic conditions creating a very high level of sediment stability in the lagoon, as discussed below in Section 2.3, provides a useful explanation for the limited need for maintenance dredging. The Swan Island Group's recommended changes to the technology assignment flowcharts provide for these assumptions to be confirmed in the remedial design process. Details of the recommendations are presented in Section 3.1 below.

2.3 High Sediment Stability in Swan Island Lagoon

EPA recognized the stable nature of sediments in the SI SDU when it assigned ENR to Reliably Contained PTW⁵ in Alternatives B-D, consistent with the FMD technology assignment decision flowchart (e.g., see FS Appendix D). However, EPA also stated that removal of sediments with PCB concentrations greater than 200 µg/kg (categorized as PTW) was necessary because of the perceived lack of permanence of in-place remedial technologies such as ENR and capping within the SI SDU due to concerns related to propeller wash and FMD requirements.

We agree with EPA's use of ENR applied to Reliably Contained PTW and support its use in Swan Island Lagoon, given its stable sediment environment, and we now offer to provide some technical support to EPA in clarifying where in-place remedial technologies such as ENR and caps can be used in the SI SDU. In that regard, Attachment C to this document provides a detailed summary of the data presented in the RI (EPA 2016c) and FS (EPA 2016a) that relate to the stability of sediments in the SI SDU.

The long-term sediment stability in Swan Island Lagoon is demonstrated by multiple factors documented in the RI and FS:

1. Low current velocities measured in the lagoon
2. The fine-grained nature of surface sediments
3. Stable bathymetry
4. Net accumulation of sediments at the downstream portion of the lagoon
5. Bio-geochemical conditions in the lagoon and the presence of a benthic invertebrate community.

The potential for effects on sediments from propeller wash by deep draft vessels varies greatly, depending on the size of the vessel and the depth of water. Modeling conducted for the Site (LWG 2012, Appendix Fb) and cited by EPA in the FS indicates that medium-sized ocean-going

⁵ As stated above in footnote 2, with respect to EPA's designation of a 200 µg/kg PCB PTW threshold and Remedial Action Level (RAL), technical and other arguments with respect to EPA's approach are presented in separate comments by members of the Swan Island Group. While submission of this optimized approach incorporates the 200 µg/kg PTW threshold for illustrative purposes, those members of the Swan Island Group do not intend that this submission waives their opposition to that PTW threshold and RAL, or otherwise indicates a lack of support for the arguments presented in separate comments on this and other topics.

vessels, the largest expected to enter Swan Island Lagoon, cause sediment disturbance of less than one foot in depth. This suggests that cover layers more than one foot thick over the existing sediment surface would prevent disturbance of subsurface contamination in affected areas. In addition, disturbances from propeller wash are expected to be small in scale and cause localized resuspension and mixing of the surface layers. Thus the effects of propeller wash will be highly localized, can be effectively managed through remedial design, and can be monitored as necessary post-remedy. As a result, in-place remedial technologies such as ENR and capping should be considered for the SI SDU.

Given the physical stability of sediments in the SI SDU, in-place remedial technologies are comparable to dredging (i.e., removal technologies) in terms of their permanence. Further, in-place technologies limit the release of contaminants during construction as compared to the unavoidable resuspension, dissolved releases, and residuals associated with removal technologies.

2.4 Surface Sediment and Fish Tissue Concentrations Are Generally Lower than Evaluated in the Feasibility Study

Data collected during recent sampling efforts show that PCB concentrations in the SI SDU surface sediments are mostly lower than what was used in the FS evaluation (Figure 3). Twenty-six additional samples collected from 2014 to 2016 were co-located with previous sampling locations for data that were used in the FS (Geosyntec, 2016). Seventy-five percent of these samples show reduced PCB concentrations. This trend is supported by PCB concentrations measured in smallmouth bass from the SI SDU as part of a fish tissue sampling event ordered by EPA in 2012 (LWG 2013). The average PCB concentrations were nearly seven-fold lower in fish samples than reported for the RI sampling in 2002/2007. RI fish tissue samples collected in 2002 and 2007 had a mean PCB concentration of 3,026 µg/kg, whereas the mean concentration from the 2012 sampling was 447 µg/kg.

These recent data indicate that the potential viability of natural recovery within SI SDU needs to be reassessed and, if natural recovery is confirmed to be occurring at an acceptable rate, MNR should be explicitly included in the potential remedial technologies considered for the SI SDU.

2.5 Source Control and Potential for Recontamination Must be Considered

EPA acknowledged that additional site characterization would be important to verify assumptions made in prior documents and in the development of remedial designs for the Site. The Swan Island Group agrees with this approach and believes that future sampling should be conducted to provide data to evaluate the potential for recontamination of remediated surfaces by discrete sources and/or general anthropogenic site-specific background at the SI SDU. EPA's national guidance on sediment remediation emphasizes the need for source control

(Horinko 2002) and accurate characterization of site-specific background levels (EPA 2004, 2005). An updated understanding of recontamination potential will be important at the remedial design stage in assessing the magnitude of the effort required and implications of achieving EPA's remedial goals with a sediment-only remedy in an urban waterway.

3.0 Recommendations for an Optimized Remedial Approach

Based on the key elements identified in Section 2.0, certain adjustments should be made to the remedial technology assignment process reflected in an SI SDU-specific flowchart and included in the FS and the ROD. For the most part, the proposed adjustments retain and enhance the flexibility of EPA's remedial technology assignments for the SI SDU with the goal of optimizing the remedial alternative to be selected. The combination of updating data and refining certain assumptions related to key issues such as FMD and current bathymetry and providing for increased flexibility in the technology assignments will ultimately result in an optimized remedial alternative for the SI SDU.

Key elements of the remedy and design process are as follows:

- 1) *Apply a mix of remedial technologies within the RAL footprint.*** Incorporating current and future waterfront uses, required navigation depths, and other site-specific factors, in combination with adjustments to EPA's remedial technology assignment flowcharts, will result in an optimized assignment of remedial technologies. The additional remedial design investigations will further refine and inform the final cleanup design.
- 2) *Apply ENR or MNR in the remainder of the SI SDU (outside the RAL footprint) to further reduce exposure and risk from PCBs and other COCs.*** Application of ENR or MNR to these areas would be evaluated for surficial PCB sediment concentrations less than the RAL. The targeted areas would be based upon results obtained through remedial design investigations.
- 3) *Conduct monitoring programs to assess performance and recontamination potential to help establish long-term remedial goals.*** Monitoring programs will be necessary to measure performance of the remedy and to help determine the final remediation goals for the SI SDU.

3.1 The Technology Assignment Decision Process Should be Adjusted to Accommodate Site-Specific Conditions

Based on the SI SDU-specific considerations discussed in the preceding sections, certain adjustments to EPA's remedial technology assignment decision process for shallow (elevation above 4 feet NAVD88), intermediate (below 4 feet NAVD88), and Swan Island Lagoon FMD areas are warranted. These technology assignments are common among Alternatives B through I (EPA FS pg 3-38) and are used Site-wide. In each of these Site-wide flowcharts, EPA included decision criteria and technology assignments specifically for the unique characteristics of SI SDU. To simplify implementation of the flowcharts, we believe that EPA should create a

single, unified SI SDU-specific technology assignment flowchart (shown in Figure 4). Changes to EPA's flowcharts made in preparing the SI SDU-specific flowchart are described below and correspond to red numerals on Figure 4. The rest of EPA's flowcharts were not altered in substance, but were re-formatted to fit on a single page.

The flowchart shown in Figure 4 contains the following adjustments to the concepts included in EPA's technology assignment flowcharts:

1. Replace "Broadcast GAC" with "Broadcast GAC/ENR" for intermediate regions outside the RAL and within Reliably Contained PTW boundaries. This change differentiates between areas with and without PTW and allows for carbon additions where EPA assigned ENR in Alternatives B–D. It also makes the flow chart consistent with the FS text that states: "ENR is being considered for the area in Swan Island Lagoon that is outside the SMAs to reduce risks. Where PTW is identified, treatment technologies will also be assigned" (EPA 2016b pg 3-30–3-31).
2. Replace "EMNR" with "ENR/MNR" for intermediate areas outside the RAL and outside Reliably Contained PTW boundaries. ENR may not be appropriate in areas of the basin subject to higher bottom shear velocities (e.g., such as at the mouth of the lagoon). Also, ENR may not be needed in all areas if MNR would be appropriate based on local conditions (such as COC concentrations and sedimentation rates). Depending on the different remedy components ultimately selected and the associated overall predicted Surface-Weighted Average Concentrations (SWACs), MNR may be a suitable technology in portions of the SI SDU. This is supported by the recently collected data, as described in Section 2.4.
3. Replace "Dredge to DOCR [Depth of Contamination to be Removed] with Residual Layer" to Dredge to the lesser of DOCR or adequate depth below FMD navigation depth and use the intermediate technology assignment." Use the intermediate flowchart when FMD area bottom depths are adequately (≥ 3 feet) below navigational depth. The jump from FMD to intermediate technology assignments will allow for optimal technology assignment to the remaining sediment with PCB concentrations above the RAL using the logic of EPA's multi-criteria decision matrix (EPA 2016a Figure 3.4-16) to select the best remedial technology following further design phase studies.
4. Replace "Reactive Cap" with "Reactive Cap/Broadcast GAC/ENR" for intermediate areas that designate Engineered Cap and are within Reliably Contained PTW boundaries. This change allows for flexibility in assigning the appropriate technology if an area of the SI SDU were to be "designated as Engineered Cap." We believe that if Broadcast GAC/ENR technology is applicable to Reliably Contained PTW as presented by EPA in Alternatives B–D, then it is logically consistent that the technology should also be applicable to the same areas in all alternatives, or at least retained for further consideration during remedial design.

5. Replace "Dredge to DOCR/Reactive Residual Layer" with "Dredge to the lesser of DOCR or 3 ft with Residual Layer³" for intermediate areas that designate "Dredge" and are within Reliably Contained PTW boundaries. Explanatory footnote # 3 states that "If DOCR is greater or equal to 3 ft apply Reactive Residual Layer."

Consistent with the above changes, the multi-criteria decision matrix set forth FS Figure 3.4-16, should clarify that cap/cover technologies (e.g., Engineered Cap, Broadcast GAC [note that although this term is used generally here, other forms may be appropriate], and ENR) can be implemented in the SI SDU FS-defined propeller wash areas when site investigation demonstrates that the navigational depth is adequate to resist erosive forces.

3.2 Maintain Flexibility in the Remedial Design Process based on a Series of Site-Specific Investigations

The proposed optimized approach described above provides flexibility in the remedial design process. The proposal is not dependent upon a change to the Alternative I RALs or EPA's definition of Reliably Contained PTW. Furthermore, it includes a series of site-specific investigations that have been and will be conducted during the remedial design phase to evaluate key assumptions and uncertainties in the RI and FS. The results will inform the design of the remedial actions and may identify the need for additional data and investigations. These could include:

- a. Baseline data collection including biota, sediment chemistry (lateral extent and depth), bathymetry, and surface water data to establish the current conditions at the SI SDU, and to evaluate changes in conditions since the RI/FS. Sediment data collection would be part of an overall monitoring plan for the SI SDU and would provide a baseline to evaluate performance of the remedy.
- b. Analysis of sediment stability to evaluate the permanence of ENR and the optimum thickness of ENR layers needed for the remedy. Stability analysis would include consideration of river currents and the potential for disturbance by vessel propeller wash. The analysis would build upon the previous FS evaluations.
- c. Studies to identify the potential need for, and effectiveness of, *in situ* treatment with GAC or other amendments to further reduce contaminant mobility or toxicity in areas where PCB concentrations are greater than 200 µg/kg. The studies, depending on the objectives and needs, could involve field-scale efforts

to determine the effectiveness of ENR or a combination of GAC amendments and ENR.

- d. Studies to assess potential sources of recontamination to remediated areas and control of those sources, including storm water loading, riverbank erosion, overwater activities and other local and regional sources. These studies are needed to identify achievable remediation goals for sediment in the SI SDU. Overall results will be important for assessing the magnitude and implications for achieving EPA's long-term remedial goals with a sediment-only remedy in an urban waterway.
- e. Evaluation of other conditions that provide information for the remedial design. These could include consideration of current and future waterfront activities, navigational maintenance depth requirements, and the extent of debris or other submerged material.

3.3 Optimized Remedial Alternative

The recommended approach discussed herein enhances the flexibility in remedial design to account for conditions within the SI SDU that are known today but were not taken into account by EPA in developing its remedial alternative, as well as accommodates new data and analysis that must be performed during the remedial design phase. Figure 5 presents a conceptual depiction of an optimized remedy that could result from this approach. It uses the PCB concentration data employed in the FS/PP, existing data and analyses relating to sediment stability and propeller wash, and information gathered by the Swan Island Group about navigation depth needs for current and future uses of the lagoon.

Based on the current understanding of navigation depths, areas needing additional depth would be dredged to elevations sufficiently below the required navigational depth to allow for implementation of any additional remedial technology per the adjusted technology assignment flow chart (for example 3 feet). In summary, the optimized remedy would provide for:

- dredging of sediments in the FMD to allow implementation of additional remedial technologies;
- ENR with amendments as well as armoring to protect against propeller wash in the berth areas;
- assuming that future site investigation demonstrates no adverse propeller wash impacts and thus ENR permanence, ENR with amendments (GAC, for example) in the lagoon areas away from the berths;

- dredging of sediment in dry dock areas to adequate depth and placement of a residual layer where PCB concentrations in the leave surface exceed the RAL;
- ENR with amendments in lagoon areas outside the FMD zone where PCB concentrations at the sediment surface exceed the RAL; and
- Either MNR or ENR in areas outside the PCB RAL footprint, depending on the results of sampling and other studies performed during remedial design.

4.0 Comparative Analysis of Optimized Remedial Alternative and EPA Alternative I for the SI SDU

A comparative analysis of EPA's Alternative I and the optimized remedial alternative for the SI SDU was developed on the basis of criteria specified in the NCP for CERCLA remedies. The optimized remedial alternative is described in Section 3.3 and depicted in Figure 5. See Table 1 for a comparison of some basic parameters of both approaches.

Table 1. Comparison of EPA Alternative I and Swan Island SDU Optimized Remedy

Technology Application	EPA Proposed Plan Alternative I	SI SDU Optimized Remedy
Dredging (acres)	52	24
Capping (acres) ⁴	2	6
Enhanced Natural Recovery/Monitored Natural Recovery (acres)	72	66
Enhanced Natural Recovery +Activated Carbon (acres)	0 ¹	34
Estimated Construction Cost (\$ Million)	\$236 ²	\$114 ²
Construction Duration (years)	6	3
Post-Remedy PCB SWAC (ug/kg)	16 ³	14

1 Activated carbon was included in Alternative I, but details of application were not specified.

2 Total undiscounted costs presented in 2016 dollars

3 This SWAC is for Alternative E from the EPA 2015 Draft FS. Alternative E is identical to the 2016 Draft Final FS Alternative I.

4 Capping area is within the dredge footprint

4.1 Overall Protection of Human Health and the Environment Is Equivalent Under Optimized Remedial Alternative and Alternative I

The optimized remedial alternative and EPA's Alternative I would both be protective of human health and the environment in the SI SDU. The objective of both alternatives is to reduce and/or isolate PCB concentrations to the greatest extent practicable. In addition, under both alternatives SI SDU sediments having the highest PCB concentrations would be removed with all sediments in the RAL footprint being removed or capped. One primary difference between the two alternatives is that the optimized remedial alternative employs a suite of remedial

technologies, including ENR with GAC or other technologies, to address portions of the sediment area with PCB concentrations that exceed the RAL. ENR and GAC have been demonstrated to effectively reduce exposure and risk from PCBs and other bioaccumulative chemical contaminants, and the PP EPA's preferred remedial alternative includes a combination of ENR and activated carbon to address sediments with PCB concentrations greater than the RAL that will not be dredged.

In the FS, EPA assessed remedy effectiveness primarily on the basis of the PCB SWAC following completion of remedy construction. EPA's overall PCB SWAC estimate in the SI SDU for Alternative I is 48 µg/kg. However, this SWAC value reflects only the effect of remediation at dredged and dredge/cap areas of Alternative I and does not account for the effect of ENR. The reasons why EPA has excluded ENR are not clear because EPA appears to consider ENR an effective remedy, as seen in the FS which states that ENR would be effective in meeting the Preliminary Remediation Goals (EPA 2016a Appendix D). Moreover, EPA explicitly accounted for the effect of ENR on SWACs in the 2015 Draft FS, where the estimated post-construction SWAC for the SI SDU for Alternative E was 16 µg/kg (EPA 2015).

The 2015 Alternative E SWAC of 16 µg/kg is a good estimate for Alternative I because the alternatives are the same for the SI SDU. The corresponding PCB SWAC for the optimized remedial alternative is 14 µg/kg. While the EPA's Alternative I and the optimized remedial alternative result in more than a 90% reduction from baseline conditions, neither SWAC value is below the PCB remedial goal of 9 µg/kg. Nevertheless, EPA indicates that residual risks for Alternative I generally meet the interim risk-based targets for evaluating overall protectiveness (1E-4 for cancer risks, and a hazard index of 10 for noncancer risks; FS Section 4.1.3). The optimized remedial alternative would also meet the interim risk-based targets based on EPA's evaluation of SWACs for the purpose of determining their effectiveness.

EPA's Alternative I includes extensive use of activated carbon to further reduce exposure and bioaccumulation of PCBs. These materials reduce the availability of the contaminant to the food chain by reducing the soluble fraction. The optimized remedial alternative incorporates ENR with potential application of activated carbon to 43 acres of the overall ENR area, thereby providing additional risk reduction by reducing bioavailability and bioaccumulation of PCBs from treated areas, which will be refined based on further remedial design studies. Activated carbon added to thin-layer sediment covers can reduce bioaccumulation of PCBs by 60 to 90% (e.g., Beckingham and Ghosh 2011; Fadaei et al. 2015). Therefore, given the high sediment stability of the SI SDU, ENR and activated carbon should be considered as active remedial technologies.

One key factor in the overall protectiveness of a remedy, as well as its long-term effectiveness and permanence, is the potential for external sources to recontaminate remediated surfaces.

Potential recontamination would affect Alternative I and the optimized remedial alternative to the same extent. Merritt et al. (2010) reviewed results for the Wycoff/Eagle Harbor (Washington), Ketchikan Pulp (Alaska), and Bremerton Naval Complex (Washington) sites and found that the primary condition adversely affecting post-construction SWACs was lack of source control and subsequent deposition of contaminated sediments on the surface of all remediation technology types, including thin layers, engineered caps, and dredged areas. Therefore, long-term success of sediment remedies relies on source control and reducing external sources of contamination. Equally important for urban/industrial settings, evaluating the success of sediment remediation also must incorporate an understanding of the uncontrollable sources of contamination that result in anthropogenic background.

Lastly, the residual risk associated with fish consumption is similar in the case of EPA's Alternative I and the optimized remedial alternative. EPA projects that fish tissue PCB concentrations exceed acceptable risk thresholds under background conditions for the key exposure scenarios it selected (i.e., subsistence and high-frequency fishers). Based on EPA's baseline risk assessment, even one 8-ounce fish meal per month would lead to PCB exposures that exceed EPA's risk thresholds (i.e., corresponding to 1E-6 cancer risk, or greater) under background conditions. Because EPA policy dictates that sediments cannot be remediated to levels below background, no functionally significant increase in fish consumption can be achieved for EPA's target receptors as a result of remediation under Alternative I or the optimized remedial alternative.

4.2 Long-Term Effectiveness and Permanence is Provided for Under Optimized Remedial Alternative and Alternative I

EPA's primary reason for utilizing more extensive dredging is that removal is a more permanent remedy than capping or covering in place using ENR or *in situ* treatment. However, this reasoning does not adequately consider the high sediment stability conditions in the SI SDU. EPA's Sediment Remediation Guidance cites sediment stability as a key factor in remediation technology assignment (EPA 2005). Under conditions of stable sediments, in-place remedies such as ENR, *in situ* treatment, and capping are as permanent as dredging for all practical purposes. Furthermore, as discussed above, thin-layer remedial actions such as ENR have been shown to be effective in isolating or reducing surface concentrations at other sediment remediation sites within EPA Region 10. For example, incorporating ENR in the Site would be consistent with EPA Region 10's ROD for the Lower Duwamish Waterway (EPA 2014) where EPA designated a PCB upper concentrations limit of approximately 36,000 to 195,000 µg/kg for use of ENR (subtidal Recovery Area 2, Table 28, LDW ROD). Furthermore, EPA made this technology assignment decision for the Lower Duwamish Waterway based on a projected ENR layer of 6 to 9 inches, which is thinner than the 12-inch layer projected for the SI SDU.

The Swan Island Group conducted a focused evaluation of sediment stability for the SI SDU (Attachment C). As noted by EPA in the FS, sediment in the SI SDU is very stable with a net deposition environment throughout the SDU, very low river currents (especially in the most contaminated areas), and very low sediment deposition rates. As discussed in Sections 2 and 3 above, mudline elevations meet navigation requirements for most of the lagoon that has such depth requirements. In these areas, in-place remedies can be applied without the risk that FMD will disrupt the applied technologies. Berth areas where maintenance dredging may be needed will likely be addressed with dredge/cap remedial technologies installed below FMD depths to accommodate future operations.

Propeller wash from vessels is also an important factor to consider. However, analysis using models recommended by EPA (see Attachment D), information on the types of ships that enter Swan Island Lagoon, and the required navigational depths, indicates that propeller wash from most vessels would disturb only the upper 6 inches of sediment and that disturbance from any vessel anticipated to use the lagoon should be less than 12 inches. Because the entire area in Swan Island Lagoon subject to large vessel traffic will be covered with a minimum 1-foot sand layer, existing sediments, or the new surfaces exposed by dredging would not be disturbed. During the remedial design phase, an appropriate safety factor for cap, ENR layer thicknesses could be calculated, as necessary, to minimize the risk of exposing underlying sediments due to propeller wash.

4.3 Equal Reduction of Toxicity, Mobility, or Volume through Treatment is Provided for Under Optimized Remedial Alternative and Alternative I

Both the optimized remedial alternative and Alternative I include the use of activated carbon in the sand cover to reduce the mobility and bioavailability of PCBs and other organic COCs. In the FS, EPA provided no quantitative evaluation of the effect of activated carbon on reducing PCB concentrations in fish tissue, and no criteria for evaluating the effectiveness of the remediation. As noted above, research publications and pilot studies conducted at other sites indicate that adding activated carbon results in more than a 90% reduction in PCB concentrations in pore water and more than an 80% reduction in PCB uptake by fish (Sun and Ghosh 2007; Ghosh et al. 2011; Fadaei et al. 2015). This represents a significant reduction in mobility, bioaccumulation, and toxicity of sediment contamination. In addition, the FS identifies activated carbon or other amendments as treatment-based technologies for PTW that can be reliably contained to reduce contaminant bioavailability. EPA has designated PTW in SI SDU as reliably containable.

4.4 Optimized Remedial Alternative Has Greater Short-Term Effectiveness

As previously discussed, the optimized remedial alternative for the SI SDU entails less dredging and larger areas of ENR as compared to EPA's Alternative I. Remedial construction operations

in the SI SDU are constrained by the in-water work windows designated to protect migrating salmon, operations of governmental entities and businesses on Swan Island and in Mock's Landing, and the availability of dredging equipment in the region. Estimates to implement Alternative I are about six years. The SI SDU Work Group estimates that the optimized remedial alternative will require three years to complete. The shorter time span for completion of the optimized remedial alternative represents substantially less disruption of business operations in the SI SDU and reduced impact on the aquatic environment. Further, because smaller volumes are associated with the optimized remedial alternative, the impacts on the community and project construction workers will be less than those that would occur under EPA's Alternative I. For these reasons, the optimized remedial alternative for the SI SDU has greater short-term effectiveness than EPA's Alternative I.

4.5 Optimized Remedy Alternative Is Easier to Implement than Alternative I

The technologies proposed for both Alternative I and the optimized remedial alternative are implementable and have been demonstrated at other Superfund sites. However, the optimized remedial alternative has a shorter estimated in-water construction duration (three years versus six years). Given that the SI SDU includes an operating port, existing commercial operations will be adversely impacted by in-water remedial activities. Conversely, the effectiveness of in-water remedial activities will be adversely impacted by commercial operations, resulting in remedial operational efficiencies of much less than the 90% assumed by the EPA. Therefore, a shorter construction duration will substantially minimize potential impacts to commercial operations and thus improve the implementability of the remedial action.

According to the PP, portions of the shoreline will undergo remediation of the bank area. Due to the river-dependent uses of river frontage properties, banks are typically steepened beyond the angle of repose associated with native soils and sediments, with that angle maintained by means of extensive arrays of pilings, riprap, or bulkhead and overwater structures. A large percentage of the SI SDU contains overwater structures (see FS Figure 3.4-23). The combination of over-steepened slopes with buildings and other structures in close proximity to the top of the river bank all but rules out any form of dredging or excavation along these shorelines. Where such work is still possible, it would be much more expensive and time-consuming than typical open-water dredging.

4.6 The Optimized Remedial Alternative Is More Cost Effective than Alternative I

The estimated capital cost of the optimized remedial alternative for the SI SDU is approximately \$114 million whereas the estimated capital cost of implementing EPA's Alternative I in the SI SDU is approximately \$236 million (both estimates use EPA's assumptions on areas, volumes, unit rates, indirect costs, and contingencies; Formation 2016). Assuming the alternatives have

the same level of environmental protection, as is shown by the analysis above, the optimized remedial alternative is clearly more cost effective.

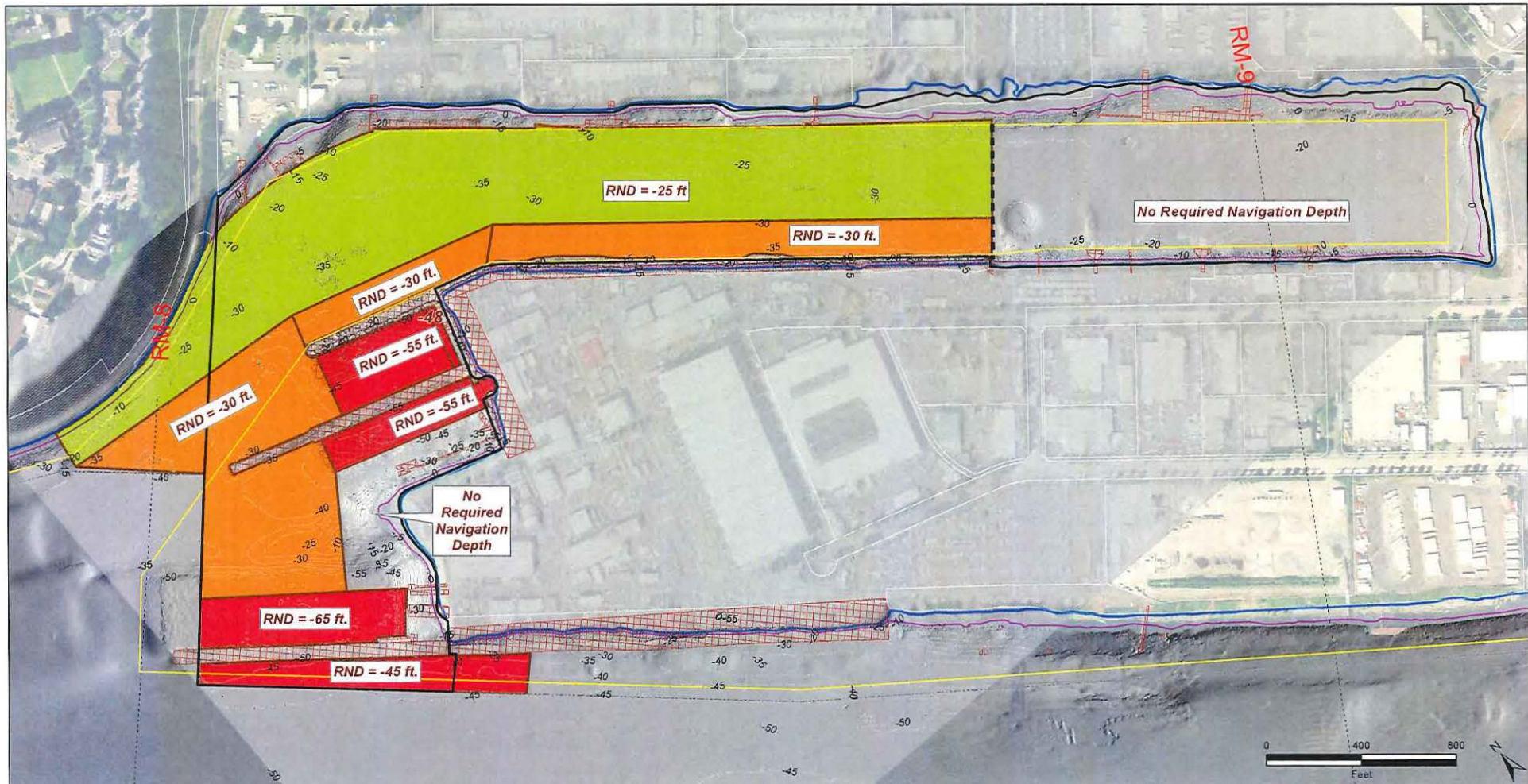
5.0 References

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Merged Bathymetry (2015, 2009, 2004) CRD contour (5-ft)
 SDU
 Harborline
 Willamette River Federal Navigation Channel
 River Miles
 OLWL (6.9 NAVD88; 1.7 CRD [@T4])
 Waterfront Taxlots (2010)
 Dock Structures (LWG, 2007)
 OHWL (20.1 NAVD88; 14.9 CRD [@T4])

Required Navigation Depth (RND, 2016)
 Required Navigation Depth Categories (RND, 2016)
 -20 to -25 ft
 -30 to -36 ft
 -45 to -65 ft

Notes:

- Based on Required Navigation Depths (RND, 2016)
- Merged Bathymetry (2015, 2009, 2004), 2014 Aerial Image
- "RND" = Required Navigation Depth

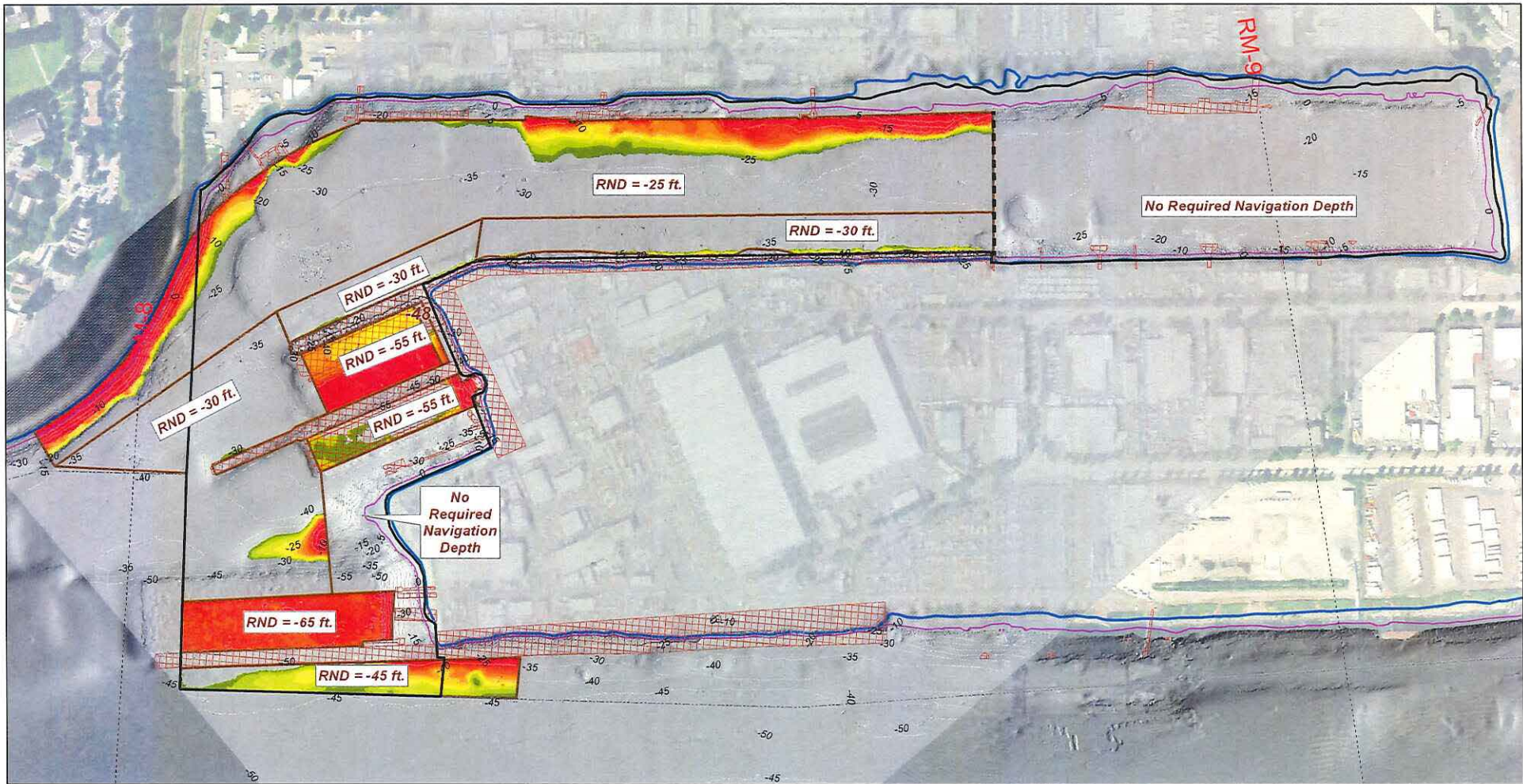
This more accurate FMD information should be incorporated into a revised FS and the ROD for the Site. Details will be updated during the remedial design phase, including the navigational needs of north shore business owners where shallower depths than currently shown may be sufficient to meet ongoing navigation requirements.

FIGURE 1
**OVERWATER STRUCTURES AND
 UPDATED REQUIRED NAVIGATION
 DEPTH (SHOWN BY FACILITY), SWAN
 ISLAND SEDIMENT DECISION UNIT**

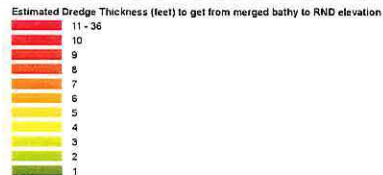
DATE: AUG 31, 2016

BY: CRL/DLL FOR: AKC

FORMATION
 ENVIRONMENTAL



- Merged Bathymetry (2015, 2009, 2004) CRD contour (5-ft)
- SDU
- Willamette River Federal Navigation Channel
- River Miles
- OLWL (6.9 NAVD88; 1.7 CRD [T4])
- Dock Structures (LWG, 2007)
- OHWL (20.1 NAVD88; 14.9 CRD [T4])
- Required Navigation Depth (PND, 2016)



- Notes:
- Based on Required Navigation Depths (RND, 2016)
 - Merged Bathymetry (2015, 2009, 2004)
 - 2014 Aerial Image
 - "RND" = Required Navigation Depth

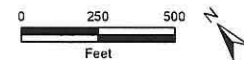
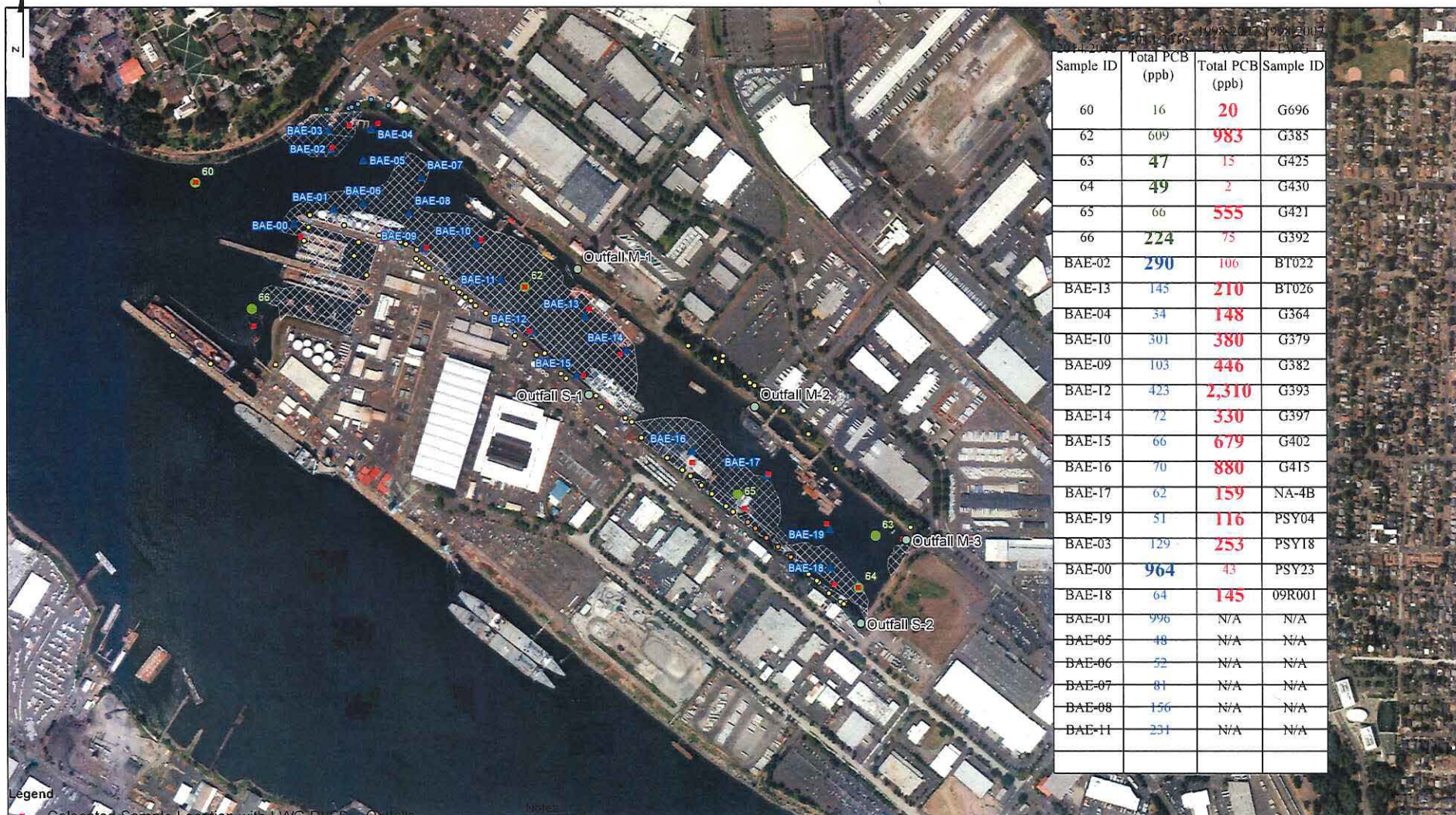


FIGURE 2
AREAS OF
THE SWAN ISLAND SDU
THAT ARE ABOVE REQUIRED
NAVIGATION DEPTHS

DATE: AUG 31, 2016

BY: CRL/DLL FOR: MCL

FORMATION
ENVIRONMENTAL



Sample ID	Total PCB (ppb)	Total PCB (ppb)	Sample ID
60	16	20	G696
62	609	983	G385
63	47	13	G425
64	49	2	G430
65	66	555	G421
66	224	75	G392
BAE-02	290	106	BT022
BAE-13	145	210	BT026
BAE-04	34	148	G364
BAE-10	301	380	G379
BAE-09	103	446	G382
BAE-12	423	2,310	G393
BAE-14	72	330	G397
BAE-15	66	679	G402
BAE-16	70	880	G415
BAE-17	62	159	NA-4B
BAE-19	51	116	PSY04
BAE-03	129	253	PSY18
BAE-00	964	43	PSY23
BAE-18	64	145	09R001
BAE-01	996	N/A	N/A
BAE-05	48	N/A	N/A
BAE-06	52	N/A	N/A
BAE-07	81	N/A	N/A
BAE-08	156	N/A	N/A
BAE-11	231	N/A	N/A

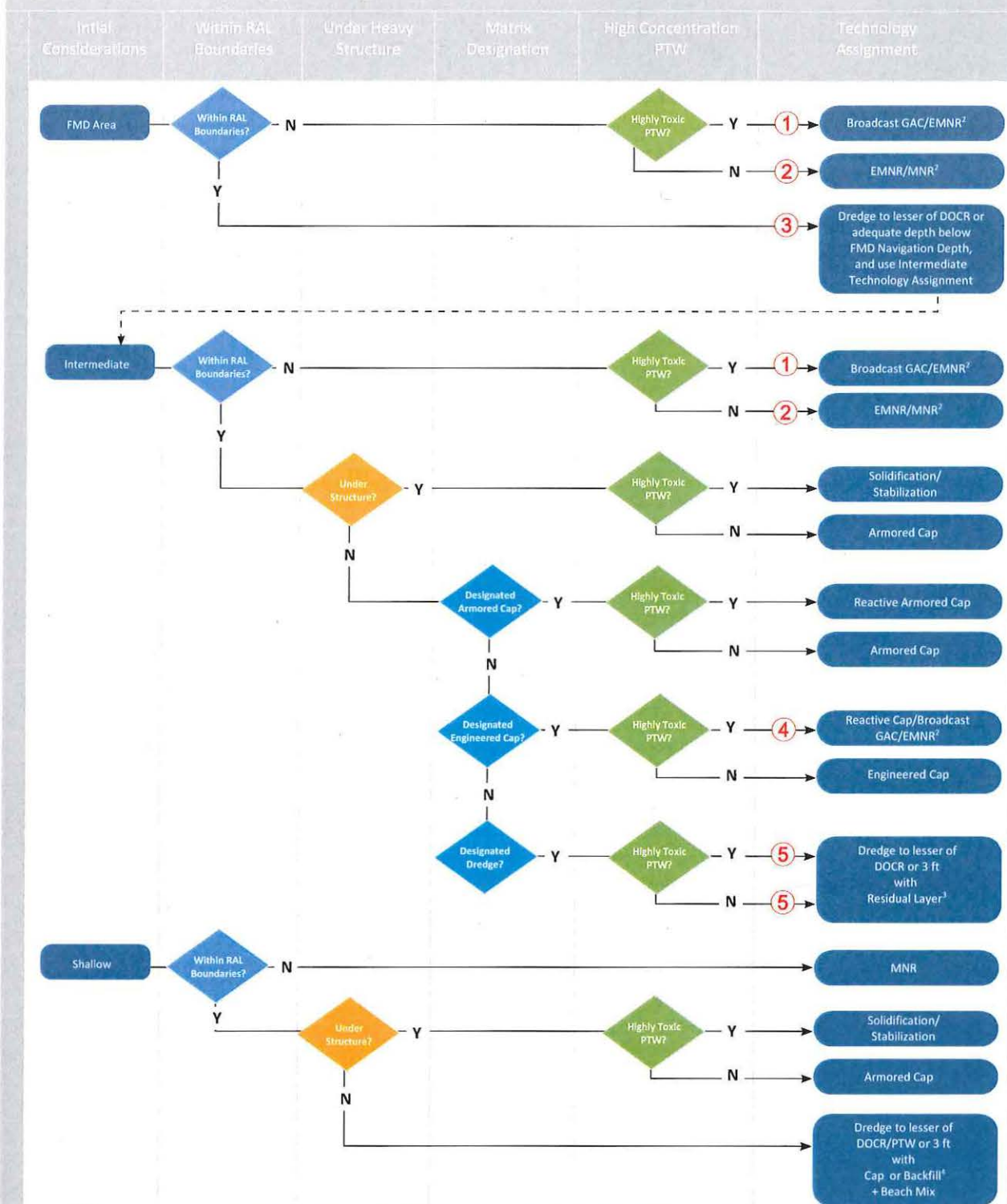
- Legend**
- Collocated Sample Location with LWG RI/FS
 - 2014 Kleinfelder Sample
 - 2016 Geosyntec Sample
 - Estimated EPA Remedial Alternative I Area
 - Private
 - City of Portland
 - Port of Portland
 - US Coast Guard

- Aerial imagery was taken in the summer of 2014 and downloaded from the City of Portland ArcGIS MapServer.
- In the table, colored text denotes total PCB concentrations (ug/kg):
 Geosyntec Sample
 Kleinfelder Sample
 LWG RI/FS Sample

Surface (0-30 cm) Sediment Sampling Results

Portland, OR		Geosyntec Portland, OR consultant June 2016		Figure 3
500 250 0 500 Feet				

Figure 4: Technology Assignments for Swan Island SDU



See accompanying text for explanation of revisions identified by red numerals.

Notes:

All Concentrations greater than RAL alternative are less than 18 feet deep in the FMD and 15 feet in the Navigation Channel. The diagram is based on the assumption that no PTW or sediment concentrations are found below these depths.

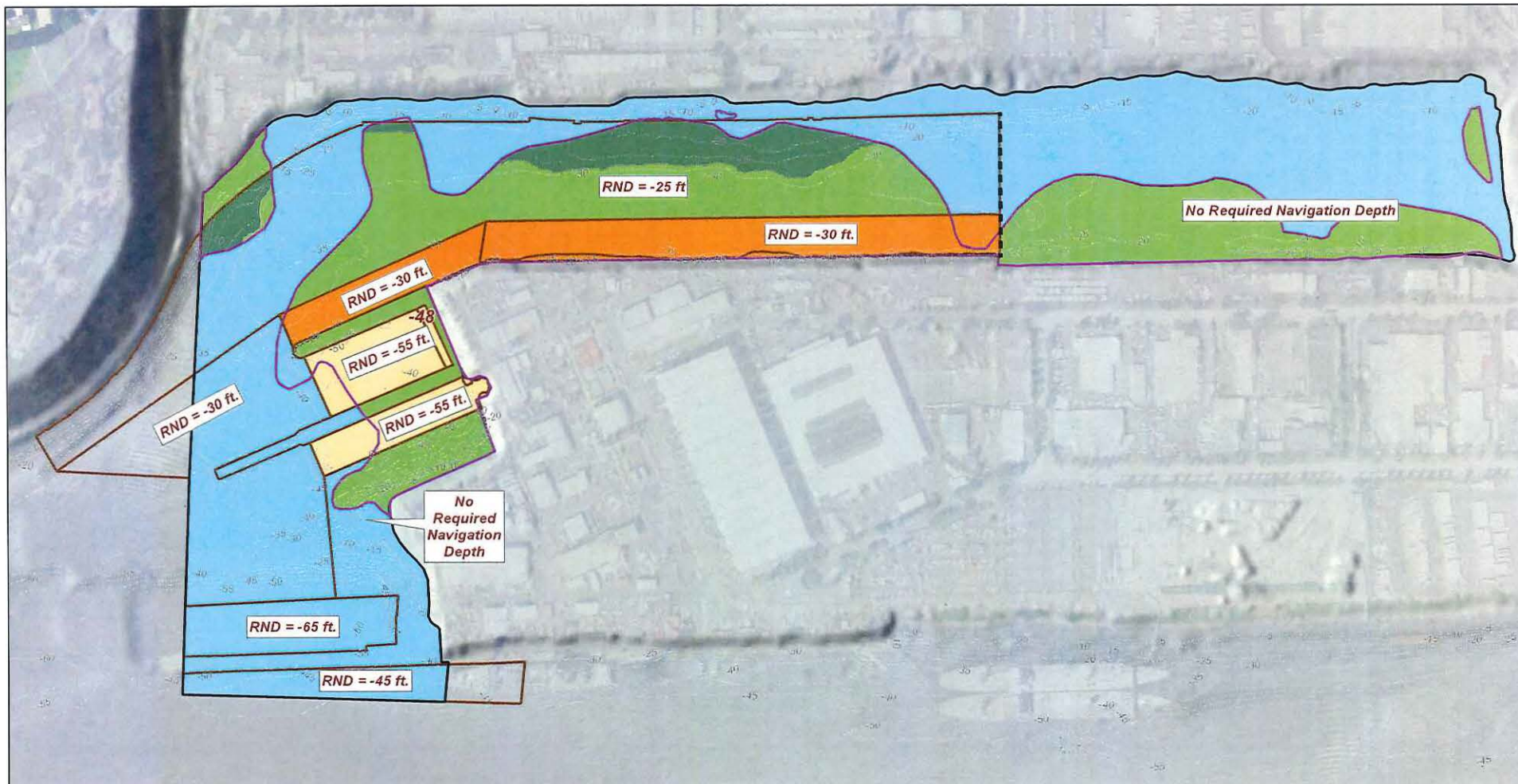
(2) In the Swan Island SDU, matrix designation and subsequent technology assignments will be determined based on remedial design studies

(3) If DOCR is greater or equal to 3 ft apply Reactive Residual Layer.

(4) DOCR/PTW > 3 ft use Reactive Engineered Cap, PTW < 3 ft, DOCR > 3 ft use Engineered Cap, or DOCR/PTW < 3 ft use Backfill.

(1) See Section 3.3.3.5 for explanation of not reliably contained PTW.

DOCR – Depth of contamination to be removed based on Remedial Action Levels (RALs)
 EMNR – Enhanced monitored natural recovery
 FMD – Future maintenance dredge
 MNR – Monitored natural recovery
 Nav – Navigation channel
 PTW – Principal threat waste



- 2009 CRD contour (5-ft Index)
- EPA Alternative I dredge footprint
- Swan Island Sediment Decision Unit
- 2016 Potential FMD (Adapted from AQ_LWG_toEPA May, 2012)

Technology

- Dry Dock Basins: Dredge to Adequate Depth Below Required Navigation Depth, Residual Layer
- ENR / MNR (areas to be determined in design)
- Enhanced Natural Recovery (ENR) + Activated Carbon (AC)
- FMD Dredge + ENR + AC
- FMD Dredge + ENR + AC + Armoring

Notes:

- Based on Potential Future Maintenance (PFM) Dredge Depths (2016 updates). [Adapted from AQ LWG to EPA May, 2012]
- 2009 Bathymetry/Contours, 2014 Aerial Image
- "RND" = Required Navigation Depth

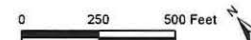


FIGURE 5
EXAMPLE
TECHNOLOGY ASSIGNMENTS
SWAN ISLAND SDU OPTIMIZED REMEDY

DATE: AUG 31, 2016
BY: CRL/DLL FOR: MCL

FORMATION
ENVIRONMENTAL

SWAN ISLAND SDU
OPTIMIZED REMEDIAL ALTERNATIVE
ATTACHMENT A

Attachment A: SIL Waterfront Use and Future Maintenance Depth Requirements

Purpose

To present information on waterfront-dependent businesses in Swan Island Lagoon and on the type of current and future uses and to use this information to evaluate future navigational depth needs.

Approach

Multnomah County Assessor tax lot information as of 4/15/2016 was obtained by the Port of Portland (Port). Tax lots that are adjacent to the waterfront (or are otherwise associated with a waterfront tax lot) in and around Swan Island Lagoon and the Shipyard were plotted in GIS and mapped on Figure 1. The following Assessor data are included in Table 1:

- Tax Lot ID
- RNO #
- Tax Lot (Site) Address
- Current Owner

Table 1 was supplemented to include information on operations, waterfront structures and usage, and where applicable, the required navigational depth for active waterfront uses. Supporting references are also provided. The following summary describes the process used to populate the additional fields.

1. Review of the operation (business) type on each tax lot was performed using publicly-available information and the results were included in the table. Publicly-available information included Multnomah County records, telephone indices, and company websites.
2. The presence of waterfront structures was documented for each tax lot based on known information and aerial photographs.
3. Where a waterfront structure was present, its water-dependent use was verified. The sources of information used to confirm a tax lot's waterfront use consisted primarily of Port staff correspondence with the business owner/operator. One exception is the U.S. Navy, where outreach has been initiated but is not complete. Citations for the communications are included.
4. Information regarding the required navigational depth for the active waterfront structures was obtained and is included in the table. The source of this information is Port staff correspondence with the business owner/operator. Citations for the communications are included.

Findings

All of the waterfront structures in and around Swan Island Lagoon are active except for two berths: Berth 308 on Swan Island, and former Berth 311 in Mocks Landing. See Table 1. These two berth areas are located toward the upstream end of the Lagoon. Neither of these berths are currently in use, and no future uses are anticipated.

Overwater structures and corresponding navigational depths (where applicable) are shown in Figure 2 and summarized by facility as follows.

1. Vigor Industrial Shipyard
 - a. Lagoon-Side Berths 301–305—berths are active for layup/ship repair. Current depth is adequate for operations at -30’.
 - b. Lagoon-Side Berths 306–307—no operational depth is required at this time.
 - c. Dry Dock Basin on the north side of Swan Island—Operational depth for the basins for Dry Docks 1 & 3 is -55’.
 - d. Vigorous Dry Dock Basin on the north side of Swan Island—operational depth is optimal at -65’; however, while this feature is located within an applicable tax lot, the structure is outside of the SI SDU.
 - e. Willamette River Side Berths—while included in the tax lot, these structures are outside of the SI SDU.
2. Port Dredge Base—mooring barges used for maintenance and moorage of dredge and attendant equipment; operational depth is -25’.
3. Marine Salvage Corporation/Fred Devine Diving & Salvage—dock structure is used for moorage and loading vessels; operational depth is -22’.
4. U.S. Navy—pier used for occasional shallow-draft vessel moorage; no operational depth requirements are anticipated.
5. U.S. Coast Guard—dock for moorage of the USCG Bluebell; operational depth is -12.65’.

Attachments

Tables

- Table 1: Swan Island SDU Waterfront Ownership and Navigation Depth Requirements.

Figures

- Figure 1: Waterfront Tax Lots Surrounding Swan Island Lagoon and Shipyard.
- Figure 2: Overwater Structures and Updated Navigation Depth Requirements (shown by facility) (provided as Figure 1 of the main document).

Attachment A

Table 1. Swan Island SDU Waterfront Ownership and Navigation Depth Requirements

Map ID	Tax Lot ID ¹	RNO#	Site Address	Owner	Operator	Operation	Are waterfront structures present?	Is there a water-dependent use?	If yes, what is waterfront usage?	Source of Waterfront Usage Information	Required Nav Depth	Source of Nav Depth Information
0	1N1E17-00301	R649840290	5555 N Channel Ave	Shipyard Commerce Center LLC	Vigor Industrial	Ship repair	Yes	Yes	Dry docks and berths for ship repair	Vigor Industrial	Berths 301-305: -30' Berths 306/307 - None at this time	Meeting with Alan Sprott (Vigor) on 3/10/2016, email from Alan Sprott (Vigor) to Kelly Madalinski (Port of Portland) on 4/11/2016; email from Alan Sprott (Vigor) to Dwight Leisle (Port of Portland) on 8/9/2016
1	1N1E17B-01100	R941170940	6735 N Basin Ave	United States of America	U.S. Naval Reserve	U.S. Navy & U.S. Marine Corps training center and administrative offices	Yes	Yes	350' pier used for occasional shallow-draft vessel moorage	U.S. Navy	None at this time	Email from Jennifer Sullivan (NAVFAC NW) to Dwight Leisle (Port of Portland) on 8/18/2016
2	1N1E17B-01200	R941170920	6767 N Basin Ave	United States of America	U.S. Coast Guard	Marine Safety Office (search & rescue, enforcement, navigation aid)	Yes	Yes	Berth for moorage of the CGC Bluebell	Email from Dennis Mead (USCG) to Fred Meyer (Port of Portland) on 3/1/2016; call between Dwight Leisle (Port of Portland) and Ana Barboza (USCG) on 8/5/2016	12.65'	
3	1N1E20-01900	R941201320	5555 W/ N Channel Ave	Shipyard Commerce Center LLC	Vigor Industrial	Ship repair	Yes	Yes	WR side berths for ship repair	Vigor Industrial	N/A - not in SDU	
4	1N1E20A-00402	R649755370	5036 N Lagoon Ave	Anchor Park LLC	William E. Scarborough Jr.	Vacant land - unknown use	No	No		Aerial photographs and Mult Co. Assessor data		
5	1N1E20A-00403	R649867690	3737 N Emerson St	City of Portland	BES Facilities/Admin Services	Parking lot for boat ramp	No	No		Aerial photographs and Mult Co. Assessor data		
6	1N1E20A-00404	R649867700	N Basin Ave	City of Portland	BES Facilities/Admin Services	Public boat ramp	Yes	Yes	Public boat ramp	https://www.portlandoregon.gov/bes/article/579568	N/A	Fred Myer (Port of Portland)
7	1N1E20AB-00100	R941200920	5160 N Lagoon Ave	Freightliner	Daimler Trucks North America	Truck manufacturing	No	No		Aerial photographs and comments from Janet Knox (Daimler's consultant)		
8	1N1E20AB-01603	R649840300	5420 N Lagoon Ave	Port of Portland (Leased)	R C Display Vans Inc.	Commercial vehicle outfitters	Yes	No		Port of Portland	None at this time	Email from Fred Meyer (Port of Portland) to Kelly Madalinski (Port of Portland) on 2/23/2016
9	1N1E20AB-01606	R649840324	5420 N Lagoon Ave	Port of Portland (Leased)	R C Display Vans Inc.	Commercial vehicle outfitters	Yes	No		Port of Portland	None at this time	Email from Fred Meyer (Port of Portland) to Kelly Madalinski (Port of Portland) on 2/23/2016
10	1N1E17CA-00400	R941171120	6208 S/ N Ensign St	Port of Portland	Navigation Dept - Dredge Base	Base of operations for Navigation Department	Yes	Yes	Mooring for dredge, barges, and equipment	Port of Portland	25'	Email from Doyle Anderson (Port of Portland) to Kelly Madalinski (Port of Portland) on 3/2/2016
11	1N1E17CA-00500	R941171030	6208 N Ensign St	Port of Portland	Navigation Dept - Dredge Base	Base of operations for Navigation Department	Yes	Yes	Mooring for dredge, barges, and equipment	Port of Portland	25'	Email from Doyle Anderson (Port of Portland) to Kelly Madalinski (Port of Portland) on 3/2/2016
12	1N1E17CA-00600	R941171010	6211 N Ensign St	The Marine Salvage Consortium	Fred Devine Diving & Salvage	Vessel salvage	Yes	Yes	Dock for moorage and loading of vessels	Marine Salvage Corporation	22'	Call on 8/4/2016 between Mr. Mick Leitz (President of MCS) and Dwight Leisle (Port of Portland)
13	1N1E17D-01901	R649870370	5949 N Basin Ave	Becker Land LLC	Becker Trucking	Transportation company	No	No		Becker Trucking LLC		
14	1N1E17D-01902	R649870380	N Basin Ave	Becker Land LLC	Becker Trucking	Transportation company	Yes	No		Becker Trucking LLC	None at this time	
15	1N1E17D-02100	R941171260	5617-5885 N Basin Ave	North Basin Watumull LLC	Northwest Paper Box	Corrugated box manufacturer	No	No		Aerial photographs		
16	1N1E17D-02200	R941171290	6135 N Basin Ave	ATC Leasing Co LLC	Automotive Carrier Services	Transportation company	No	No		Aerial photographs		
17	1N1E17D-02300	R941170520	6147 N Basin Ave	ATC Leasing Co LLC	Automotive Carrier Services	Transportation company	No	No		Aerial photographs		
18	1N1E18D-00200	R941180390	5555 W/ N Channel Ave	Shipyard Commerce Center LLC	Vigor Industrial	Ship repair	Yes	Yes	Dry docks and berths for ship repair	Vigor Industrial	Dry Docks 1 & 3 - 55'	Dry Docks 1 & 3 - Port meeting w/ Alan Sprott (Vigor) on 3/10/2016, email from Alan Sprott (Vigor) to Kelly Madalinski (Port of Portland) on 4/11/2016
19	1N1E18A-00100	R941180010	5000 N Willamette Blvd	University of Portland	University of Portland	Educational institution	No	No		Aerial photographs	Vigorous Dry Dock - 65'	Vigorous - ERM, 2010 Sediment Characterization Report

Notes:

¹ Tax Lot information from Multnomah County dated 4/15/2016



Legend

Waterfront Tax Lots

Oregon tax lot ID numbers are labeled.

0 500 1,000
Feet



FIGURE 1

WATERFRONT TAX LOTS SURROUNDING SWAN ISLAND LAGOON AND SHIPYARD

DATE: SEP 01, 2016

BY: DLL

FOR: SAM

FORMATION
ENVIRONMENTAL

SWAN ISLAND SDU
OPTIMIZED REMEDIAL ALTERNATIVE
ATTACHMENT B

Attachment B: SIL Dredge History Summary

Purpose

Information regarding the history of dredging in Swan Island Lagoon (SIL) is provided to support the evaluation of sedimentation and requirements for future maintenance dredging (FMD) in SIL.

Approach

Using the Port of Portland's historical dredge/fill records, events related to dredging in SIL or the entrance to the Lagoon are listed in Table 1 and summarized as follows:

1. The type of dredging for each event is categorized as one or more of the following:
 - a. Deepening
 - b. Maintenance dredging
 - c. Construction dredging
 - d. Rehandling (i.e., relayed material)
 - e. Erosion control
2. Where available, volumes of material are included
3. Where known, dredge depths are included in notes

Findings

SIL is a constructed feature that was created in the 1920s when a causeway was built to connect the island to the mainland (effectively creating a peninsula). The lagoon is a quiescent environment that is not subject to the normal flows of the Willamette River and as such, the rate of sedimentation or introduction of sediment to the lagoon is low. This conclusion is supported by the dredging history, which shows infrequent historical need for maintenance dredging. When maintenance dredging did occur, it took place either in the vicinity of the approach to the lagoon or at discrete berths and docks.

A summary of key findings from the review of the dredge history follows.

1. Initial dredging to deepen the lagoon likely occurred in the early 1940s in connection with the construction of the Kaiser Shipyard for the United States during WWII; however, records from that time period do not provide sufficient details to confirm where dredging occurred within the SIL, or to what depth. These initial dredging events are not included in the table.
2. The earliest documented deepening of the lagoon was in 1951 and was likely associated with the conversion of the downstream end of Swan Island to a ship repair yard.
3. Following the 1951 deepening, maintenance dredging of the approach to the lagoon and areas adjacent to Berths 301–305 was performed in 1955, 1956, and 1957. The 1950s were the last

time dredging was performed that may have covered the central portion of the lagoon for the express purpose of maintaining the depth. The entrance to the lagoon was also dredged in 1971 to a depth of -35', although it is unclear if that was related to channel deepening or channel maintenance.

4. Beginning in the 1960s, the lagoon was used as a "relay" location for rehandling material dredged from other locations, mainly channel deepening and maintenance in the main channel of the Willamette River. Sediment dredged from the channel was pumped into the lagoon until it could be repumped into Mocks Landing or the end of the lagoon for use as fill material. Between approximately 1961 and 1973,¹ dredge material was periodically transferred into the lagoon and later redredged and pumped into adjacent upland areas. Records show that the rehandling largely occurred at the upstream end of the lagoon, which is now filled land. This is likely due to the fact that the area had less activity and vessel traffic than the downstream part of the lagoon.

As shown on Table 1, the rehandling activities make up the majority of the volume of material dredged from the lagoon over time. One thing that is unclear, however, is if the lagoon was maintained to a certain depth by virtue of the rehandling. In other words, it is not clear if the lagoon was over dredged at the time of rehandling to accomplish the needed depth at the same time.

5. Other dredging events in the lagoon were focused on nearshore areas at berths and docks, both for construction and for maintenance. Table 1 shows that the last maintenance dredging that occurred in the lagoon was in 1986 at Berths 306, 307, and 308, with a small amount of material (1,200 cubic yards) removed.
6. From 1975 to 2000, the Port held a joint permit issued by the Corps and DSL that covered annual maintenance dredging at all of its properties with waterfront uses. Along with lagoon berths at the Shipyard, the permit consistently showed, and allowed for, maintenance dredging in the middle of the lagoon to -30 feet. However, based on documentation of dredging activities, it appears that lagoon maintenance was simply allowed under the permit, but was never performed.

Considerations

- Private dredging may not be accurately represented in the table. For example, Fred Devine reported that it conducted maintenance dredging at its dock in 1973, which is not depicted in the table.

¹ In 1974, a berm was constructed across the end of the lagoon to facilitate filling of that area. Material was either pumped or brought in by barge to complete the fill.

Attachment B

Table 1 - Swan Island Lagoon Dredging History

Parties Involved	Year	Dredged Area	Approx Volume (cubic yards)	Filled Area	Dredging Type	Dredge Depth (where available)
USACE Port of Portland	1951	Swan Island Basin Dredging Channel	568,715 ?	Mocks Landing - roadway fill along east bank of Swan Island Basin/Mocks Landing property acquired from Multnomah County	Lagoon Deepening	
USACE Port of Portland	1953	North end of Swan Island/entrance to Swan Island Basin	743,830 ?-1,676,880 ?	Mocks Landing - Areas A, B, and C; SW corner of Port Property north of section line, and Former Lagoon or Port Center area	Rehandling	
USACE Port of Portland	1955	Relay dumps near the upstream and downstream ends of Swan Island	392,642 ?	Mocks Landing	Rehandling	
USACE Port of Portland ?	1955	Downstream end of Swan Island (approach to dry docks and lagoon)	104,674 ?	Mocks Landing shore and parking lot	Maintenance Dredging	
USACE Port of Portland	1956	Channel approach to Dry Docks; PSRY Berths 1 and 2 - Port job 1315	149,482 ?	Mocks Landing - Area A (Area 5) (Kaiser Parking Lot)	Maintenance Dredging	
USACE Port of Portland	1957	Downstream end of Swan Island Basin adjacent to Swan Island outfitting dock berths 4 and 5 - Port job 1322	120,684 ?	Mocks Landing - Area A (Area 5) (NW of Kaiser Parking Lot)	Maintenance Dredging	
USACE Port of Portland Forest Investment Co.	1961	Swan Island Basin (pick up from relay)	58,000 ?-70,254 ?	Mocks Landing - Old Kaiser Parking area	Rehandling	
General Construction Port of Portland	1962	PSRY - Berths 306, 307, 308	12,420	Swan Island Lagoon (In-water directly across from Berth 307)	Construction/Maintenance Dredging	Berths were dredged to -20 feet
USACE Port of Portland	1962	Central Portion of Swan Island Lagoon; Rehandled from Lagoon to Mocks Landing.	370,445 ?	Mocks Landing - Old Kaiser Parking area and North of parking area	Rehandling	
USACE Port of Portland	1963-1964	Swan Island Basin	>1,400,000	Mocks Landing - Areas A-C	Rehandling	
Sea-Land Port of Portland	1963	Sea-Land Barge Basin, Swan Island Lagoon	12,000-15,766 ?	UNK	Construction Dredging	
USACE Port of Portland	1963	Near Entrance of Swan Island Basin	81,000 ?	Shipway end area (Lower end of Swan Island)	Dredging for fill	
Sea-Land Service Inc. Port of Portland	Sept 1965	Sea-Land Service Inc. Dock area	88,550-100,000 ?	Mocks Landing, Area C	Lagoon Deepening	This was done for vessel access to the Sealand Dock; dredge elevation proposed to -35' at the harbor line
Port of Portland USACE	1971	Willamette River channel at downstream end of Swan Island and entrance to Swan Island Lagoon	?	Port Center	Unknown - possibly channel deepening	Lagoon depth to be dredged was -35'
Port of Portland USACE US Navy	1972	Mouth of Swan Island Lagoon in front of U.S. Navy Site	235,527	Mocks Landing - Navy	Construction Dredging	
Port of Portland USACE	1973	Willamette River channel near Swan Island and possibly upstream end of Swan Island Lagoon (now filled land)	169,444 ?-225,981 ?	End of Swan Island Lagoon	Channel maintenance and possibly rehandling	
Port of Portland USACE DSL	1973	PSRY Berths 302 - 305	~2,500	End of Swan Island Lagoon	Emergency maintenance dredging	Dredging was required due to low water conditions that were present at that time; the depth needed to be -30 to accommodate vessels
Port of Portland Fred Devine (Marine Salvage Consortium) DSL USACE	1973-1974	Port Dredge Base	16,000-25,000	End of Swan Island Lagoon and Current Dredge Base Upland	Construction Dredging	Initial dredging was to -20'
Port of Portland USACE DSL	1976	Swan Island Lagoon upstream of Berth 308	<8,600	End of Swan Island Lagoon	Construction Dredging	
Fred Devine (Marine Salvage Consortium) Port of Portland	March-July 1979	Fred Devine Dockfront	<25,000	EOSIL	Construction and Maintenance Dredging	Dredging was to -10'

Attachment B

Table 1 - Swan Island Lagoon Dredging History

Parties Involved	Year	Dredged Area	Approx Volume (cubic yards)	Filled Area	Dredging Type	Dredge Depth (where available)
Fred Devine (Marine Salvage Consortium) Port of Portland	1984–1989	Fred Devine Dock	1,000 per year	UNK	Maintenance Dredging	Dredge depth permitted to -20'
Port of Portland U.S. Navy	1985	U.S. Navy Dock	18,000	UNK	Construction Dredging	Dredge depth was -30'
Port of Portland Unknown contractor	1985	Berths 301-305	23,700	End of Swan Island Lagoon	Maintenance Dredging	Dredging was to -33'
Port of Portland Eagle Elsner Inc. Benge Construction Co. Jackson Marine USACE	1986–1989	Boat Ramp Area in Swan Island Lagoon	200	Boat Ramp Area in Swan Island Lagoon	Construction Dredging	
Jackson Marine Port of Portland	1986	PSRY - Berths 306, 307, 308	1,200	EOSIL	Maintenance Dredging	
Port of Portland, City of Portland	1988	Swan Island Lagoon	290	End of Swan Island Lagoon	Construction Dredging (for outfall at the end of the lagoon)	
Port of Portland Eudaly Bros.	1991	Swan Island Boat Ramp	100	UNK	Erosion Control	

SWAN ISLAND SDU
OPTIMIZED REMEDIAL ALTERNATIVE
ATTACHMENT C

ATTACHMENT C

SWAN ISLAND LAGOON SEDIMENT STABILITY

Summary Statement: The physical stability of sediments in Swan Island Lagoon (SIL) indicates the permanence of in-place technologies (e.g., capping, *in situ* treatment, enhanced monitored natural recovery (ENR), and monitored natural recovery (MNR)) is comparable to removal technologies (e.g., dredging). Because sediments here are stable, in-place technologies such as MNR and ENR can provide permanent remedies meeting all aspects of the National Contingency Plan (NCP) short and long-term effectiveness criteria. Additional benefits of in-place technologies include reduced greenhouse gas emissions and reduced risks associated with the transport and handling of contaminated materials. Further, in-place technologies limit the release of contaminants during construction as compared to the unavoidable resuspension, dissolved releases, and residuals inherent to removal technologies.

1. HYDRODYNAMIC CONDITIONS IN SWAN ISLAND ARE SUITABLE FOR IN-PLACE REMEDIAL TECHNOLOGIES

River currents are greatly attenuated in the quiescent off-channel SIL area, encouraging deposition and stimulating natural recovery processes.

- a. **Low Current Velocities.** Acoustic Doppler Current Profilers (ADCPs) were deployed in the Willamette River during three different higher-flow periods between 2002 and 2004 (see Appendix La to the Draft Feasibility Study [LWG Draft FS; Anchor QEA 2012]; DEA 2002). These data show relatively strong currents in the main channel of the Willamette River that generally ranged from 1 to 2 feet per second at the time of the surveys. The currents are strongest near the middle of the channel and decrease considerably near shore. Velocities measured at two locations within SIL were considerably lower (approximately 0.3 foot per second or lower). These measurements in SIL are consistent with ADCP measurements made in other off-channel areas of the Portland Harbor, such as the slips at Terminal 4 (BBL 2005).
- b. **Ongoing Sedimentation and Natural Recovery.** Relatively clean and fine-grained sediments from the main channel of the river tend to enter and deposit within SIL, contributing to ongoing natural recovery processes.
 - i. **Fine-Grained Sediments.** Fine-grained sediments deposit and accumulate in quiescent areas. Based on a visual inspection of EPA Draft Final FS Figure 2.2-1, the majority of surface sediments in SIL have 60% or greater fines content and nearly half of the surface sediments in SIL have greater than 80% fines.

- ii. **Sedimentation.** Based on bathymetric changes from 2003 to 2009 (LWG Draft FS Figure 2.1-2), the majority of SIL is net depositional. Specifically, the multi-beam bathymetry data collected over this period indicate the mudline has accreted over the first two-thirds of SIL by 7.5 to 15 cm (or more in some areas), while the remaining one-third further back in SIL had little to no discernable accretion. The EPA Draft Final FS Figure 3.4-19 shows similar conclusions.
- iii. **Buried Contamination.** In an area that is depositional and in which known sources have been reduced over time, differences between surface and deep sediment concentrations can provide evidence that recovery is occurring, as newly depositing sediments with lower concentrations of contaminants deposit above the historical deposits with higher concentrations. For example, analysis of surface and subsurface sediment data in SIL shows that, on average, subsurface sediment polychlorinated biphenyls (PCBs) are higher by nearly a factor of two compared to surface sediments (see first bar on attached Figure 1).
- iv. **Sediment Profile Image (SPI) Survey.** SPI surveys conducted in 2001 and 2013 provide an assessment of the succession (or maturity) of the benthic infaunal community at SIL (Striplin 2002; Germano 2014). Following a sediment disturbance, the benthic community will typically progress from Stage 1 (initial colonization by opportunistic and rapidly reproducing surface feeders) to Stage 3 (mature community with larger, slower growing, and more deeply burrowing organisms). The prevalence of Stage 3 communities at SIL provides another independent line of evidence for sediment stability.
 - 1. In 2001, approximately 80% of the stations in the SIL SDU showed evidence of mature Stage 3 community structures, the only exception being the north corner of the lagoon. Across the entire study area, 46% of sampling locations showed evidence of mature Stage 3 community structures.
 - 2. Following sampling in 2013 the percentage of mature Stage 3 community structures across the entire study area rose from 46% in 2001 to 71%, and of these Stage 3 sample location 80% remained Stage 3 from 2001 to 2013 providing evidence of persistent sediment stability over time. To the extent that benthic succession was encouraged by reduced contaminant stressors, this provides evidence of ongoing natural recovery.

2. POTENTIAL SEDIMENT DISTURBANCE MECHANISMS

Potential sediment disturbance mechanisms can be shown to have little or no likelihood of remobilizing surface or subsurface contaminants in SIL, as discussed in each of the following subsections.

- a. **Extreme Flood Events.** SIL provides off-channel protection from main channel river currents, even during extreme flood events, because there is no flow-through. No flood scour was predicted by the model in SIL during the 1996 Spring Flood event due to low predicted shear stresses in this area (see Appendix La of the LWG Draft FS, Figures 3-3 and 3-4 and Figure 3.4-18 of the EPA Draft Final FS). Thus, extreme flood events are not likely to remobilize surface or subsurface contaminants.
- b. **Propwash.** The evaluation of propwash potential conducted as part of the Draft FS (see Appendix C, Table C-20 of EPA Draft Final FS) found that the depth of sediment disturbance would normally be relatively shallow (less than 1 foot). Given this relatively shallow depth of disturbance, much of the buried contamination would not be disturbed by this process. And because current velocities are low in SIL (even during high-flow events), most of the sediments disturbed by propwash would redeposit back to the sediment bed at or near their initial location.
- c. **Maintenance Dredging.** Model predictions and construction monitoring data show that suspended sediments can be well controlled during maintenance dredging in SIL with appropriate Best Management Practices and monitoring protocols. Further, where in-place technologies such as MNR are used to remediate contaminated sediments, maintenance dredging in most of SIL is relatively shallow. Such dredging will generally be disturbing more recent and less contaminated sediment layers to maintain existing navigation water depths and is unlikely to liberate older, buried contaminants. Further, the attached Figure 2 shows that current water depths in SIL are sufficient for navigation in much of the lagoon (this figure is provided as Figure 1 to the main document); given that considerable time has passed since navigational dredging was required in this area, it is anticipated that navigational dredging will not be needed in the future. If deeper sediments do require dredging to provide new and greater navigation depth, then the Oregon\Portland Sediment Evaluation Team process would ensure that any contaminated sediments were properly managed, and any newly exposed surface material would be as good as or better than the quality of existing surface sediments.

- d. **In-Water Construction.** Regulatory programs are in place to control in-water construction activities and to ensure adequate environmental protections are employed to prevent the release of contaminants.
 - i. **Portland Harbor Interagency Permit Coordination Team.** A team, consisting of EPA, USACE, DEQ, DSL, and NOAA reviews all proposed in-water permitting projects within and upstream of the Portland Harbor, including the Downtown Reach.
 - ii. **Portland Sediment Evaluation Team.** This team, consisting of USACE, EPA, DEQ, DSL, and NOAA, reviews all dredging projects in the Portland District in accordance with the Sediment Evaluation Framework for the Pacific Northwest (USACE et al. 2009).
- e. **Earthquakes.** Ash Creek Associates completed a detailed assessment of the seismic environment as part of the Terminal 4 Confined Disposal Facility 60% Design Study (2011). This analysis included “mega thrust” earthquakes along the Cascadia Subduction Zone and shallower crustal earthquakes along known or hypothetical faults. Existing site-specific geotechnical data at SIL have not been studied in detail. However, the subsurface conditions are expected to be similar in nature to other areas of the river.
 - i. **Deformation of Waterway Floors.** Recent surface sediments, some of which may be contaminated, and the upper layers of underlying river alluvium may be subject to liquefaction during an earthquake. However, SIL contaminants are concentrated on relatively flat waterway floors where there is little or no gravitational driving force to displace them. As a result, there may be isolated areas of settlement and movement, but sediments should not move far from their original location within the SIL and should not be released to the main river channel.
 - ii. **Deformation of Sediment Caps.** If SIL sediments were capped, the caps could be susceptible to liquefaction under certain seismic events, and similar responses are anticipated. On the relatively flat waterway floors, some cap thinning may occur due to consolidation after liquefaction or lateral cap movement. However, deformed or damaged caps could be easily repaired after the event.
 - iii. **Deformation of SIL Sidewall.** If impacted sediments are identified on adjacent banks, sidewall slopes of 50% (2 horizontal to 1 vertical) or steeper may be present. If liquefaction were to occur on these slopes, runout of the impacted sediment further into the SIL would be anticipated. Runout into the river is unlikely but would need to be further assessed in detail. Engineering measures, such as a cap and rock

buttress at the toe of the cap area, would likely reduce the runout of impacted sediment.

3. REFERENCES

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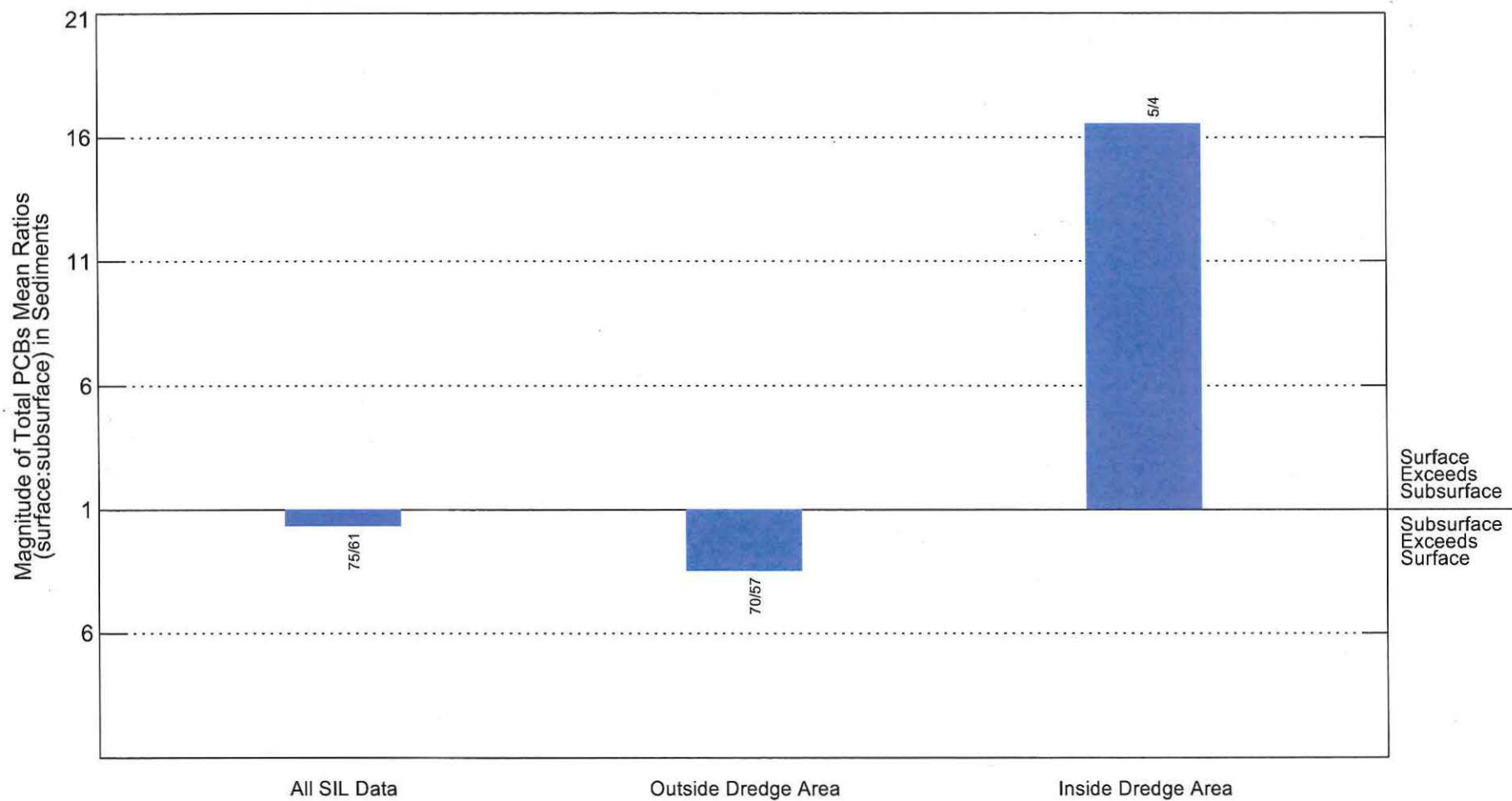
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XX/YY is the count of surface samples (XX) and subsurface samples (YY) included in ratio.

Figure 1

Portland Harbor RI/FS
Total PCBs Mean Surface/Subsurface
Concentration Ratios in Swan Island Lagoon Sediment



DO NOT QUOTE OR CITE
This document is currently under review by US EPA
and its federal, state, and tribal partners, and is subject
to change in whole or in part.

SWAN ISLAND SDU
OPTIMIZED REMEDIAL ALTERNATIVE
ATTACHMENT D

Attachment D

Effectiveness Evaluation for Enhanced Monitored Natural Recovery

Purpose and Scope:

Enhanced Monitored Natural Recovery (ENR) is an important part of the U.S. Environmental Protection Agency (EPA) Preferred Alternative I (EPA 2016a) and the Swan Island Sediment Decision Unit (SI SDU) Optimized Alternative. EPA stated in the Feasibility Study (EPA 2016b) (FS) that ENR is an effective technology for reducing exposure from PCBs and attaining Preliminary Remediation Goals (PRGs) in the SI SDU. In the technology assignment process, EPA identified ENR for areas within Remedial Action Level (RAL) footprints that contain "Principal Threat Waste," but are not addressed by either dredging or engineered cap.

However, EPA did not account for the effect of ENR on Surface Weighted Average Concentrations (SWACs) in the SI SDU. For the Preferred Alternative I, EPA did not prescribe ENR in areas with PCB concentrations above the 200 ug/kg RAL. The Optimized Alternative allows for ENR in areas of sediment with PCB concentrations greater than the RAL. The analysis presented herein is intended to assess the potential effectiveness of an ENR layer using the same tool that EPA used to evaluate cap effectiveness and in the PTW analysis to determine whether PCBs in Portland Harbor could be reliably contained. The tool is the "Steady-State Cap Design Model" (Version 1.19) based on Lampert and Reible (2009).

Input Variables and Analysis:

The steady-state conditions version of the model for passive caps was used to evaluate tetra-chlorine polychlorinated biphenyl homologs, which is the same analyte group used by EPA in the PTW analysis to identify concentrations that are "reliably contained" (Appendix D, EPA 2016). Model input and output variables are shown in Table 1. Default values for model parameters were used except:

- a. Octanol-water partition coefficient, $\log K_{ow} = 6.6$ (*the same value as used by EPA*).
- b. Contaminant Pore Water Concentration, C_0 = variable, see below.
- c. Organic Carbon Concentration in Bioactive zone of Sediments, $(f_{oc})_{bio} = 1.5\%$ (approximate site average).
- d. Conventional Cap placed depth = 30 cm (*this is the thickness of the ENR layer cited by EPA for the preferred alternative*).
- e. Pore water Concentration at Depth, $C(z)$ = variable (*this is the concentration cited by EPA as the goal for cap pore water, and is the PRG for PCBs for Remedial Action Objective 8*).

Other input parameter values were the same as used by EPA. The model run was conducted by changing the parameter C_0 until the $C(z)$ was equal to or less than the 0.014 ug/L, which is the goal cited by EPA in Appendix D (Table D7-7) and is the PRG for PCBs for Remedial Action Objective 8 (RAO8).

The value for contaminant pore water PCB concentration ($C(z)$) was converted to bulk sediment concentration (C_{sed}) using equilibrium partitioning assumptions (EPA 2003), as shown in Table 2.

Results:

Based on this analysis, the concentration of (tetra) PCBs in the pore water of the ENR layer would not exceed the RAO8 PRG unless PCB concentration exceeded about 1,200 ug/kg in the bulk sediment underlying the ENR layer.

References Cited:

Lampert, D.J. and Reible, D.D. 2009. An Analytical Modeling Approach for Evaluation of Capping of Contaminated Sediments. *Soil & Sediment Contamination*, 2009, 18(4):470-488.

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EPA (US Environmental Protection Agency). 2016a. Portland Harbor Superfund Site. Superfund Proposed Plan. USEPA Region 10. June.

EPA (US Environmental Protection Agency). 2016b. Portland Harbor RI/FS, Feasibility Study. USEPA Region 10. June.

Table 1. Model Structure and Input Variables

STEADY-STATE CAP DESIGN MODEL

from Lampert and Reible (2009)*

Version 1.19

6/8/2012

Instructions: This spreadsheet determines concentrations and fluxes in a sediment cap at steady-state, assuming advection, diffusion, dispersion, bioturbation, deposition/erosion, sorption onto colloidal organic matter, and boundary layer mass transfer. The deposition velocity is negative in the case of erosion, and is assumed to be constant and to have minimal effect on the thickness of the cap. The cells in GREEN are input cells; these can be changed for the design of interest. Cells in YELLOW are commonly used parameter estimates. These can be changed but note that physically unrealistic parameter values may result. A second worksheet calculates the transient profiles for a semi-infinite case. **DO NOT CHANGE THE CELLS IN RED** (or the spreadsheet will not function properly). These are calculated values for model outputs. The third worksheet title "array" allows the user to create an array of outputs for a given input (e.g., to study different compounds for a given site).

Contaminant Properties

Contaminant

Octanol-water partition coefficient, $\log K_{ow}$

Water Diffusivity, D_w

Cap Decay Rate, λ_1

Bioturbation Layer Decay Rate, λ_2

EPA value for Tetra PCB homologs

6.6

$6.0E-06 \text{ cm}^2/\text{s}$

0.00 yr^{-1}

0.00 yr^{-1}

Sediment Properties

Contaminant Pore Water Concentration, C_0

Biological Active Zone fraction organic carbon, $(f_{oc})_{bio}$

Colloidal Organic Carbon Concentration, ρ_{DOC}

Darcy Velocity, V (positive is upwelling)

Depositional Velocity, V_{dep} (positive is deposition of sediments)

Bioturbation Layer Thickness, h_{bio}

Pore Water Biodiffusion Coefficient, D_{bio}^{pw}

Particle Biodiffusion Coefficient, D_{bio}^p

1.6 ug/L

Vary this value until cell C(z) is below critical value (RAO 8 = 0.014 ug/L)

0.015

0 mg/L

10 cm/yr

0 cm/yr

15 cm

100 cm^2/yr

1 cm^2/yr

Cap Properties

Conventional Cap placed depth

Cap Materials -Granular (G) or Consolidated Silty/Clay (C)

Cap consolidation depth

Underlying sediment consolidation due to cap placement

Porosity, ε

30 cm

Represents a one-foot sand layer equivalent to ENR

G

0 cm

15 cm

0.4

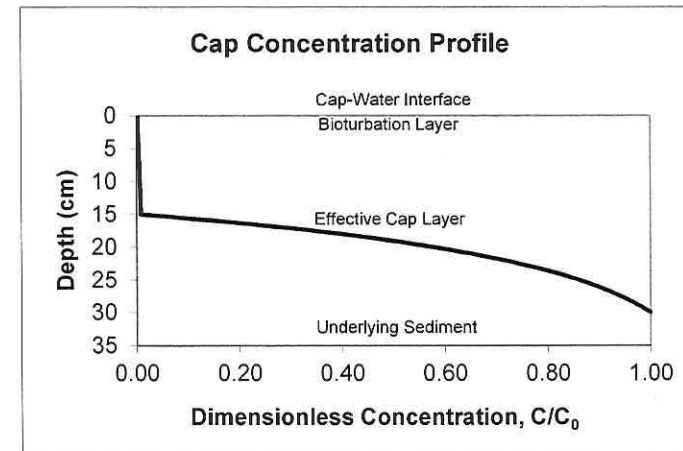


Table 1. Model Structure and Input Variables

Particle Density, ρ_p	2.6 g/cm ³
fraction organic carbon, $(f_{oc})_{eff}$	0.0006
Depth of Interest, z	15 cm
Fraction organic carbon at depth of interest, $f_{oc}(z)$	0.0006

Commonly Used Parameter Estimates

Organic Carbon Partition Coefficient, $\log K_{oc}$	6.05 log L/kg
Colloidal Organic Carbon Partition Coefficient, $\log K_{DOC}$	5.68 log L/kg
Boundary Layer Mass Transfer Coefficient, k_{bl}	0.75 cm/hr
Dispersivity, α	1.50 cm (not allowed to be less than 1 cm)
Effective Cap Layer Diffusion/Dispersion Coeff., D_1	71 cm ² /yr
Bioturbation Layer Diffusion/Dispersion Coeff., D_2	26657 cm ² /yr

Output

Pore Water Concentration at Depth, $C(z)$	0.013 ug/L
Loading at Depth, $W(z)$	8.8 ug/kg
Average Bioturbation Layer Loading, $(W_{bio})_{avg}$	134 ug/kg
Flux to Overlying Water Column, J	182 ug/m ² /yr
Cap-Bioturbation Interface Concentration, C_{bio}/C_0 , C_{bio}	0.81%
Cap-Water Interface Concentration, C_{bl}/C_0 , C_{bl}	0.17%
Average Bioturbation Concentration, $(C_{bio})_{avg}/C_0$, $(C_{bio})_{avg}$	0.49%
Characteristic Time to ~1% of steady state, $t_{adv/diff}$	185.7 yr

This value needs to be under 0.014 ug/L (EPA FS Table D7-7)

Dimensionless Parameters

Effective Cap Layer Peclet No., Pe_1	2.12
Effective Cap Layer Damkohler No., Da_1	0.00
$\beta = \text{SQRT}(Pe_1^2/4 + Da_1)$	1.06
Bioturbation Layer Peclet No., Pe_2	0.01
Bioturbation Layer Damkohler No., Da_2	0.00
$\gamma = \text{SQRT}(Pe_2^2/4 + Da_2)$	0.004
Sherwood Number at Interface, Sh	3.7

Other Parameters

Cap final thickness, h_{cap}	29.99 cm
Cap Effective thickness w/ot bioturbation layer, h_{eff}	15 cm
Containment Layer Retardation Factor, R_1	1060
Bioturbation Layer Retardation Factor, R_2	26486

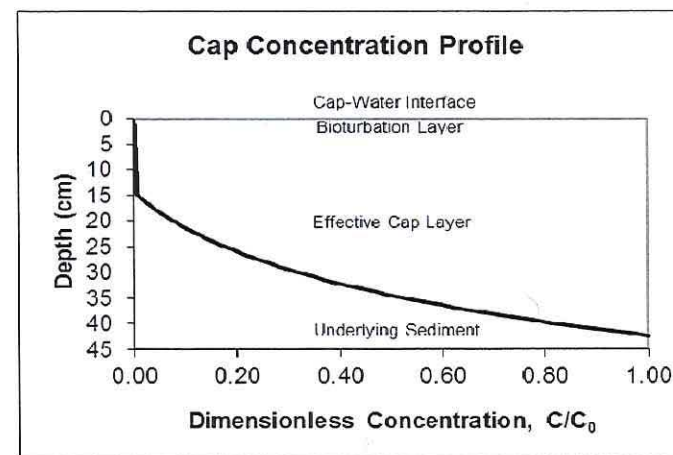


Table 1. Model Structure and Input Variables

Effective Advective Velocity, U	10.00 cm/yr	(not allowed to be more negative than that which will offset diffusion)
Characteristic Advection Time-cap layer, t_{adv}	1588.3 yr	
Characteristic Diffusion Time-cap layer, t_{diff}	210.2 yr	
Characteristic Reaction Time-cap layer, t_{decay}	infinity yr	

*Lampert, D.J. and Reible, D.D. 2009. "An Analytical Modeling Approach for Evaluation of Capping of Contaminated Sediments," Soil & Sediment Contamination, 2009, 18(4):470-488.

Table 2. Calculation of PCB concentration in Sediment Underling ENR that would result in Cap porewater PCB equal to RAO 8 PRG.

Equation: $C_{sed} = C(z) * (Koc * f_{oc})$ [based on EPA 2003]

Param	Description	Value	Units	Source
Input parameters				
C(z)	Concentration of PCB in sediment porewater underlying the cap that results in 0.014 ug/L in pore water of cap.	1.6	ug/L	Steady state estimate from Reible cap model (see Cells B45 and B16 in Tab: Steady State Conditions)
Koc	Organic C - water partition coefficient.	78,100	L/kg	Value for PCB77 cited by EPA in 2016 FS
foc	Fraction of bulk sediment that is organic carbon	0.01		estimate for ENR layer carbon content
Output				
Csed	Concentration in Sediment that results in pore water conc. equal to RAO 8 PRG	1,250	ug/kg	This represents estimate of Sediment concentration that would be successfully contained by a 1-foot sand layer.

APPENDIX A1



MEMORANDUM

TO: Megan Decker, Assistant General Counsel, Port of Portland
Kelly Madalinski, Environmental Program Manager, Port of Portland

FROM: Mark Lewis, Andy Koulermos and Sara Moore, Formation Environmental

DATE: August 31, 2016

SUBJECT: Port of Portland Comments on EPA Preferred Remedial Alternative for the Swan Island Sediment Decision Unit

This technical memorandum was prepared on behalf of the Port of Portland (Port) by Formation Environmental to summarize some key comments on the US Environmental Protection Agency (EPA) Preferred Remedy for the Swan Island Sediment Decision Unit (SI SDU) portion of the Portland Harbor Superfund Site (Superfund Site). EPA released its Proposed Plan for the Superfund Site in June 2016 (EPA 2016a). The Preferred Alternative is based on analysis provided in the Draft Final Portland Harbor Feasibility Study (Feasibility Study)(EPA 2016b). The Preferred Alternative includes a cleanup plan for the SI SDU that is heavily focused on dredging (over 700,000 cubic yards of sediments removed from 52 acres). Implementing the Preferred Alternative will have severe adverse environmental and economic impacts on the Swan Island area. Assumptions EPA relies upon for the Preferred Alternative do not reflect the key site-specific conditions for SI SDU, resulting in a remedial alternative that is not compliant with the NCP, and not supported by science and engineering principles identified in EPA sediment remediation guidance (2005).

One key issue with the Feasibility Study and Proposed Plan is that EPA based the remedy selection for all Sediment Decision Units (SDUs) on a single, generalized harbor-wide approach that fails to account for the wide diversity of environmental conditions within and among SDUs. The environment in the SI SDU is not found elsewhere in the Superfund Site, and is not accounted for in EPA's technology assignment process. A more site-specific risk management framework that fully considers actual conditions, and is consistent with EPA sediment remediation guidance (2005) and the NCP would result in an equally protective, implementable,

and less costly remedy that has lower short-term impact on the community and environment. An optimized remedial approach that accomplishes these goals is presented in SI SDU Workgroup 2016.

The Port disagrees with EPA on several key aspects associated with the technology assignment process developed for the SI SDU in the Feasibility Study (EPA 2016b):

- The Harborwide Remedial Goals identified by EPA are not achievable for the SI SDU.
- EPA designates Principal Threat Waste (PTW) in a way that is inconsistent with the NCP and nationwide EPA guidance, and inconsistent with other sites in EPA Region 10.
- EPA's analysis of effectiveness for SI SDU Remedial Alternatives is incomplete.
- EPA Assumes that in-place remedies are not applicable in Future Maintenance Dredge (FMD) Areas, and are not adequately permanent for the SI SDU.
- Dredging should not be mandated in all Future Maintenance Dredge Areas

The first four items are discussed further below. The last two are addressed under separate cover as part of a proposed Optimized Remedial Alternative (SI SDU Workgroup 2016).

1. Overview of Swan Island Sediment Decision Unit

The SI SDU is located between River Miles 8 and 9 on the northeast side of the Lower Willamette River. As defined by EPA in the Feasibility Study, the SI SDU covers approximately 120 acres. The entire SDU is located outside of the main channel of the Willamette River, and is comprised mostly of Swan Island Lagoon, a blind-end industrial slip and berthing area that is approximately 1 mile long and 500 feet wide. Current, historical, and anticipated future use surrounding the SDU is industrial, marine, and commercial. No ship repair, berthing, or cargo related activities occur in the upstream (blind) end of the lagoon. The more downstream parts of the SDU currently house the largest commercial ship repair yard on the west coast of the United States. Dry docks and basins to support ship repair businesses are located on the downstream end of Swan Island Lagoon, which includes the deepest parts of the SDU.

Water depths are relatively shallow (<20 feet) at the upstream (blind) end of the lagoon, but depths are generally 30 feet or deeper throughout the rest of the lagoon where the ship repair yard, marine berths, and associated access areas are located. Because the area surrounding the lagoon is highly developed with hardened surfaces, the rate of sedimentation from erosion or storm water runoff is relatively low.

The physical environment of the SDU should be a key factor in considering applicable remedial technologies. The off-channel and enclosed nature of the lagoon results in a hydrologically quiescent environment in which river sediments are physically stable. Long-term sediment stability is an important factor identified in EPA's national sediment remediation guidance (2005). Substantial information confirming sediment stability for Swan Island Lagoon is presented in the Feasibility Study and the Remedial Investigation Report for Portland Harbor (EPA 2016c):

1. Low current velocities in the lagoon
2. The fine-grained nature of surface sediments
3. Net accumulation of sediments at the downstream portion of the SDU, but a natural lack of deposition or scour in the majority of the lagoon
4. Development of a mature benthic invertebrate community and associated biogeochemical conditions that are consistent with stable sediments in a quiescent marine environment (LWG 2015)

The stability of sediments in the SI SDU is a key factor that should be considered along with navigation requirements and current bathymetry in evaluating the applicability and effectiveness of remedial technologies. EPA has not adequately considered these factors in comparing remedial alternatives in the Feasibility and selecting the Preferred Alternative.

2. EPA Preferred Alternative for the Swan Island Sediment Decision Unit

The key features for all of the remedial alternatives considered for the SI SDU in the Feasibility Study include areas of dredging to remove surface and subsurface sediments; relatively minor areas of capping mostly along shorelines and piers with restricted access or where dredging might disrupt geotechnical stability; and large areas of Enhanced Natural Recovery (ENR). For purposes of the Feasibility Study, EPA assumed ENR to be a 1-foot thick sand layer over the remainder of the SDU that is not dredged or capped. Activated carbon added to dredge residual layers, ENR, and caps are also included in areas of highest residual concentrations of Chemicals of Concern (COCs).

The most significant difference among the alternatives considered in the Feasibility Study is the balance between the dredging and ENR areas. The footprint for dredging is defined by the Remedial Action Level (RAL), which is different for each alternative. Alternative B has the highest RAL (1,000 ug/kg polychlorinated biphenyls [PCBs]), the lowest amount of dredging, and the largest area of ENR. Alternative G has the lowest RAL (50 ug/kg PCBs), the largest amount

of dredging, and smallest area of ENR. The difference in cost among the alternatives is roughly proportional to the amount of dredging.

Alternative I, which is EPA's Preferred Alternative, includes a RAL of 200 ug/kg for PCBs. Dredging is the primary remedial component, with substantial areas of ENR (Figure 1):

1. 52 acres of active dredging to remove contaminated sediment, and subsequent covering by residual sand layers;
2. 2 acres comprising relatively minor areas of capping mostly along shorelines and piers with restricted access or where dredging might disrupt geotechnical stability; and
3. 72 acres of ENR consisting of a 1-foot thick sand layer over the remainder of the SDU.

Some areas of residual sand layers or ENR would be augmented by the addition of activated carbon (e.g., AquaGate+PAC) to help reduce the bioavailability of PCBs and other organic COCs. Appendix P of the Feasibility Study shows that Alternative I includes over 1,900 cubic yards of AquaGate+PAC for the SI SDU, but does not specify where it would be used. The overall capital cost of the Preferred Alternative for SI SDU is estimated to be about \$236 million using EPA's methodology to develop costs including unit rates, indirect costs, and contingencies.

3. The Harborwide Remedial Goals Identified by EPA Are not Achievable for the SI SDU

EPA has set the sediment Remedial Goal (RG) for PCBs at 9 ug/kg because it asserts that this concentration is representative of the sediment background for Portland Harbor, based on sediment samples collected from the Willamette River upstream of the Portland metro area (EPA 2016b). EPA assumes that this background estimate is achievable throughout the Superfund Site. EPA adopted background as the RG because the Preliminary Remediation Goals (PRGs) they calculated based on exposure scenarios for fish consumption result in values that are more than ten times lower than the background estimate. The urban/industrial environment that drains to Swan Island Lagoon is likely to result in some recontamination of remediated surfaces to levels higher than the RGs, especially for ubiquitous chemicals such as PCBs. If concentrations from the sources exceed background, they can prevent achieving the background-based RGs in localized areas such as the SI SDU.

Data from storm water sampling in Swan Island Lagoon shows that PCB concentrations on fine particulates range from 35 ug/kg (City Outfall M2) to 371 ug/kg (City Outfall M1) (Anchor and Integral 2008), which exceed the 9 ug/kg RG by a substantial margin. The source of PCBs in the

storm water samples is unknown, and could be from specific sources in the drainage, general anthropogenic background for urban/industrial settings, or both.

Substantial analysis is also available to show that harbor-wide background is likely higher than 9 ug/kg (LWG 2014), particularly so in the unique settings such as the SI SDU where the quiescent environment results in deposition of fine-grained sediments that tend to bind greater amounts of organic contaminants. Sediment background concentrations for the Superfund Site were the subject of a formal dispute between the Lower Willamette Group (LWG) and EPA. In documents supporting the dispute, LWG cited multiple lines of evidence showing that the harbor-wide background should be no less than about 20 ug/kg (LWG 2014). If so, post-remedy sediment concentrations of PCBs cannot achieve the RG, and EPA should not evaluate the long-term effectiveness of the remedial alternatives based on whether they achieve this level.

Merritt et al. (2010) reviewed results for Wycoff/Eagle Harbor (Washington), Ketchikan Pulp (Alaska), and Bremerton Naval Complex (Washington). For each of these sites, the primary condition adversely affecting post-construction surface-area weighted average concentrations (SWACs) was lack of source control and subsequent deposition of contaminated sediments on the surface of all remediation technology types, including thin-layers, engineered caps, and dredged areas. Therefore, long-term success of sediment remedies relies on source control and reducing external sources of contamination. Equally important for urban/industrial settings, evaluating the success of sediment remediation also must incorporate an understanding of the uncontrollable sources of contamination that result in anthropogenic background.

At a minimum, additional data are needed to assess the potential recontamination of surfaces in the SI SDU. If recontamination potential exceeds the RG, then analysis is needed to identify and control specific sources in the drainage, and the SDU-specific anthropogenic background should be characterized. Based on this analysis, it may be necessary to develop an alternative RG based on achievable sediment COC concentrations.

4. EPA Designates the PTW Toxicity Concentration Inconsistent with the National Contingency Plan (NCP), Guidance, and Other Sites in Region 10

Identification and use of the PTW designation appears to be a key aspect in EPA's remedial technology assignments. However, EPA's designation of PTW is inconsistent with the definition in the National Contingency Plan (NCP), EPA's national sediment guidance (EPA 2005), and EPA's characterization of PTW for the Lower Duwamish Waterway (EPA 2014). The definition for PTW in EPA guidance is highly toxic or highly mobile waste that cannot be reliably contained. Yet, EPA explicitly excluded the "reliably contained" criterion in designating sediments as PTW for the Superfund Site (EPA 2016b, pg 3-3). Furthermore, EPA's definition of concentrations as "highly toxic" is inconsistent with national guidance on identifying PTW (EPA 1991) and with the Baseline Human Health Risk Assessment (BHHRA) for the Superfund Site, which EPA prepared. EPA then used the PTW designation as a criterion for technology assignments for the alternatives.

EPA defines 200 ug/kg PCBs in sediment as a highly toxic concentration for designating whether sediments are PTW at individual sampling points. The 200 ug/kg concentration was identified based on exposure by human ingestion of fish that may bioaccumulate PCBs from sediments and other sources. EPA national guidance on PTW (EPA 1991) defines "highly toxic" based on direct exposure, not indirect exposure pathways such as food web bioaccumulation. EPA bases their calculation of "highly toxic" on fish-ingestion exposure scenario from the BHHRA which was based on averaging fish PCB concentrations over 0.5-mile or 1-mile segments of the river, which represents human fishing activities and fish use of habitat in the river. Therefore, applying their calculated "highly toxic" criterion to individual sediment sampling locations is inconsistent with national guidance and their own BHHRA for the site.

EPA's application of the PTW designation for the Superfund Site varies greatly from the recent Record of Decision (ROD) for the Lower Duwamish Waterway (EPA 2014). For the Lower Duwamish, EPA concluded that PTW for PCBs did not exist within the site because PCBs in sediments at the site were not highly mobile or highly toxic (EPA 2014, pg 115). EPA determined that sediments in the Duwamish were not highly toxic despite maximum PCB concentrations in surface and subsurface sediments of 223,000 and 890,000 ug/kg, respectively. These values are more than 1,000 and 4,000 times higher than the "highly toxic" concentration criterion that EPA applied to PCBs in the Portland Harbor Feasibility Study (EPA 2016b), even though human ingestion of fish is the primary health risk driving cleanup for both sites.

Overall, nothing associated with PTW guidance or chemical distribution at the SI SDU should compel dredging of PCB at 200 ug/kg or higher, when an in-place remedy such as ENR (possibly with *in situ* treatment) would provide equivalent protection and permanence.

5. EPA's Analysis of Effectiveness for SI SDU Remedial Alternatives Is Incomplete

ENR is a significant element in all of the remedial alternatives considered in the Feasibility Study for the SI SDU, with ENR covering over 60% of the SI SDU for Alternative I. However, despite conclusions on the applicability and effectiveness of ENR in the Swan Island Lagoon environment, EPA did not account for the effectiveness of ENR on reducing PCB SWACs and corresponding risk. SWAC and risk calculations reported for the SI SDU by EPA in Appendix J of the Feasibility Study do not reflect the benefit of ENR. This is inconsistent with EPA national remediation guidance (EPA 2005, Section 3.4), and represents a reversal of how EPA conducted the effectiveness in the draft Feasibility Study released in 2015 (EPA 2015, Table 4.2-4).

This omission results in an incomplete analysis for each alternative, and prevents meaningful comparison among the alternatives. Tables in Appendix J show that the post-construction PCB SWAC for Alternative B is about 193 ug/kg, which represents a significant reduction from the No-Action scenario, but is still higher than the EPA RG of 9 ug/kg (Appendix J, Table J2.3-7). To estimate the relative effects of ENR, the post-construction SWACs for Alternative B and Alternative I were recalculated. EPA methods were used in the recalculation by assigning dredged or capped surfaces a concentration of 0 ug/kg PCBs. ENR surfaces were assigned a range of values equal to 15% of the pre-construction sediment concentration, which is intended to reflect the potential mixing of ENR and underlying sediment during placement, and is consistent with the approach used by EPA in the 2015 draft Feasibility Study. The resulting post-construction SWACs are more representative of post-construction conditions than those presented in the Feasibility Study. The SWAC for Alternative B is approximately 27 ug/kg, which more than eight times lower than EPA's estimate without ENR, and is in the range of reasonable estimates of background. The corresponding recalculated value for Alternative I is 7 ug/kg, which is below the RG, but not sustainable over the long term because it is below even EPA's estimate of background.

Likewise, EPA's characterization of residual risk for the remedial alternatives (EPA 2016b, Table J2.3-8) does not reflect the effect of the ENR or *in situ* treatment using activated carbon in ENR or dredge residual layers. Both of these technologies are expected to result in a significant reduction on exposure of fish to PCBs, and thus exposure of humans eating the fish. Thin-layer

remedial technologies such as ENR have been shown to be effective in isolating or reducing surface concentrations at other sediment remediation sites within Region 10 (Merritt, et al. 2010). As discussed above, incorporating ENR in the Portland Harbor cleanup would be consistent with the EPA Region 10 ROD for the Lower Duwamish Waterway (EPA 2014).

Research publications indicate that adding activated carbon to sand layers results in more than 90% reduction in PCBs in pore water, and more than 80% reduction in PCB uptake by fish (Sun and Ghosh 2007, Ghosh et al. 2011, Fadaei et al. 2015). This represents a significant reduction in mobility, bioaccumulation, and toxicity of sediment contamination. Reduction in potential bioaccumulation in fish contributes directly to reducing exposure and risk to humans consuming fish from the SDU. Further, application of ENR and activated carbon to broad areas of the SI SDU would result in a rapid decrease in the SWAC for all COCs in surface sediments. This rapid decline would also lead to a rapid decline in the contribution of sediments to fish tissue concentrations of PCBs and other bioaccumulative COCs. By excluding ENR and activated carbon, EPA's analysis ignores an important factor that would reduce the estimated differences in effectiveness among the alternatives.

ENR and activated carbon contribute significantly to the overall costs of the remedies, and evaluation of their contribution to risk reduction should be included in the Feasibility Study and considered in identification of the most appropriate remedial alternative for the SI SDU.

6. EPA Assumes that In-Place Remedies Are Not Adequately Permanent for the SI SDU

EPA has indicated a preference for contaminant mass removal in the SI SDU based on a presumption that in-place remedial technologies such as ENR and capping are not adequately permanent, that active remediation in FMD areas must be dredging, and that the dredging in the Preferred Alternative requires less reliance on Institutional Controls (ICs) than ENR or capping. However, EPA appears to have underestimated sediment stability in the SDU and, correspondingly, the potential applicability of in-situ technologies such as ENR or caps.

EPA identified ENR as an applicable technology for the SI SDU, stating that ENR is expected to meet RAOs (EPA 2016b, pg 3-31). EPA states that the thickness and composition of the ENR layer will be determined during remedial design (EPA 2016b, pg 3-32), but that a "12-inch layer is sufficient to allow for mixing with the underlying sediment bed and erosion due to prop wash while also retaining clean sand above the mixed interval to minimize the potential for exposure to contaminated sediments due to bioturbation" (EPA 2016b, pg D-18). If sediments are stable

as described above, and ENR is effective as described by EPA in the Feasibility Study, then ENR should be considered for more extensive areas of the remedy in the SI SDU.

Incorporating ENR in areas of PCB concentrations greater than the 200 ug/kg limit identified for Alternative I would be consistent with EPA Region 10's decision for cleanup at the Lower Duwamish Waterway, where EPA designated the upper limit PCB concentrations for use of ENR at approximately 36,000 to 195,000 ug/kg (subtidal Recovery Area 2, Table 28, EPA 2014). Furthermore, EPA made this technology assignment decision for the Lower Duwamish Waterway based on a projected ENR layer of 6-9 inches, which is thinner than the 12-inch layer projected for the SI SDU.

7. Summary and Conclusions

In the Preferred Remedy, EPA's selected technologies for the SI SDU do not reflect technology application or analysis of effectiveness that is consistent with the NCP criteria for Feasibility Study analysis, national guidance, or other decisions within EPA Region 10. The Port believes the following factors are important for a more objective evaluation of alternatives.

EPA's Remedial Goal for PCBs ignores the realities of sediment cleanup in an industrial environment. Failure to reconsider the Remedial Goal will lead to unrealistic expectations for judging remedy success in the long-term, and result in time-consuming and expensive administrative processes potentially needed to change the RG in the future. The ROD should provide for evaluating the achievable remedial goals for the SI SDU.

EPA's approach for identification and use of PTW is inconsistent with any previous application of PTW, national guidance, and the conceptual model underlying risk analysis in BHHRA that EPA prepared for the Portland Harbor Superfund Site. This intent of this novel PTW approach appears to be to help justify more extensive dredging in the remedial alternatives. However, in the case of the SI SDU, using PTW as a criterion for dredging does not increase environmental protection, and contributes to increased environmental and economic disruption.

EPA's incomplete effectiveness analysis ignores the risk-reduction effects of ENR and activated carbon. The text of the Feasibility Study (especially Appendix D) reveals that EPA believes that ENR will be effective in reaching the remedial goal and reducing exposure and risk, so it is unclear why effects of ENR were not included when evaluating the overall effectiveness of the Alternatives. Omitting the impacts of ENR from the comparative analysis in the Feasibility

Study essentially reduces the analysis to a comparison of dredging areas, which is not an accurate representation of the overall effectiveness of the alternative.

Overall, the Port believes that EPA's Preferred Alternative is based on conservative assumptions that are unnecessary for a protective remedy, which results in unnecessarily high costs for the SI SDU. A more objective evaluation would identify a remedial alternative that is equally effective, less environmentally and economically disruptive, and less costly. A more site-specific evaluation for technology assignment was implemented in developing the proposed Optimized Remedial Alternative for SI SDU, and is described in SI SDU Workgroup 2016.

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Legend

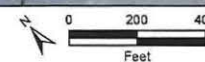
Alternative I Technology Assignment

- Cap
- Dredge
- Dredge and Residual Layer
- Dredge with Cap
- Enhanced Natural Recovery

Swan Island Sediment Decision Unit

Notes:
Chemical data obtained from the LWG FS sediment database dated 2011-03-31. In this database, only one PCB total (either Aroclor or congener based) exists for each sample.

June 2011 aerial image.



PORT OF PORTLAND

COMMENTS ON PORTLAND HARBOR PROPOSED PLAN

FIGURE 1

ALTERNATIVE I
EPA FINAL FS (JUNE 2016)

DATE: AUG 31, 2016

BY: DLL

FOR: MCL

FORMATION
ENVIRONMENTAL

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APPENDIX B

OPTIMIZED ALTERNATIVE REMEDY FOR TERMINAL 4 (RM 4.5E)

Prepared for

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/kg	micrograms per kilogram
BEBRA	Bank Excavation and Backfill Remedial Action
BERA	Baseline Ecological Risk Assessment
BHHRA	Baseline Human Health Risk Assessment
CBRA	Comprehensive Benthic Risk Area
CDF	confined disposal facility
cPAH	carcinogenic PAH
DEQ	Oregon Department of Environmental Quality
EE/CA	Engineering Evaluation/ Cost Analysis
EPA	U.S. Environmental Protection Agency
FPM	floating percentile model
FS	feasibility study
LRM	logistic regression model
mg/day	milligrams per day
NAPL	nonaqueous phase liquid
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEC	Probable Effects Concentrations
Port	Port of Portland
pre-RD	pre-Remedial Design
PRG	Preliminary Remediation Goal
RAL	removal action level
RAO	remedial action objective
RI	Remedial Investigation
RM	river mile
RM 4.5E	EPA's Sediment Decision Unit for Terminal 4
ROD	Record of Decision
SEF	Sediment Evaluation Framework
SWAC	surface-weighted average concentration

List of Acronyms and Abbreviations

T4	Terminal 4
UPRR	Union Pacific Railroad

EXECUTIVE SUMMARY

This report describes and provides supporting technical basis for an alternative remedy that the Port of Portland (Port) proposes for Terminal 4 (T4, also known as sediment decision unit RM 4.5E) based on a review and analysis of the Portland Harbor Feasibility Study (FS) and Proposed Plan recently issued by the U.S. Environmental Protection Agency (EPA 2016a, 2016b). In 2008, the Port stepped forward to perform Early Action cleanup of contaminated sediments at T4, which significantly reduced current risk levels in site sediments (Anchor QEA et al. 2009). The majority of upland sources of groundwater, stormwater, and soil contamination have been controlled through various response actions under Oregon Department of Environmental Quality oversight (DEQ 2016). The Port's proposed alternative will build on the success of these completed in-water and upland actions, will be fully protective of the actual risks that exist at the site, and will provide flexibility to adapt and modify remedial approaches during Remedial Design, so that the remedy can be informed by strategic and targeted pre-design investigations, and ensure compatibility with the Early Action and current site uses. The Port's alternative is expected to cost tens of millions of dollars less than EPA's alternative with equivalent risk reduction.

To enable this alternative, EPA should recognize that several of the human health direct-contact exposure scenarios that require public access (e.g., fishing, recreational diving, and beach use) are not applicable at T4 because public access is controlled by management of site uses and by the security and safety protocols that the Port implements pursuant to federal law.

The Port acknowledges there may be residual risks to benthic organisms at T4 associated with polycyclic aromatic hydrocarbon (PAH) contamination, although these risks were significantly curtailed by the 2008 Early Action. However, EPA's benthic risk analysis is hampered by a number of deficiencies and contradictions with the Baseline Ecological Risk Assessment (BERA; LWG 2013a) that make its application at T4 unreliable, especially given the unique characteristics of pencil pitch, a possible remaining source of PAHs at T4. A more accurate and current assessment of benthic risk should therefore be completed as part of a pre-design investigation using site-specific chemistry and toxicity data in the form of bioassay tests, for example.

EPA should apply balanced risk management principles to the site-specific conditions at T4 to develop a remedial approach that addresses the particular risks that are demonstrated to exist at the site. To enable an equally protective and more cost-effective remedy, EPA should make the following revisions to its decision documents:

- Make a site-specific risk management decision that public human health direct-contact exposure scenarios are inapplicable at T4 because of public access restrictions.
- Allow for the refinement of benthic risk areas using up-to-date chemistry and toxicity data collected during pre-remedial design investigation, rather than generic, harbor-wide Preliminary Remediation Goals that have poor reliability at T4.
- Include flexibility to adjust remedial technologies and remedial footprints based on new data collected during remedial design, resulting in a more cost-effective remedy that is better tailored to site conditions and operational requirements and does not undermine terminal slopes, nearshore structures, and previously placed caps and stabilized shorelines of the Early Action.

1 INTRODUCTION

The Port of Portland (Port) manages operations at Terminal 4 (T4) on the east bank of the Willamette River between river miles (RM) 4.2 and 5.0. T4 is also known as Sediment Decision Unit RM 4.5E.

1.1 Terminal 4 Site Layout

There are two off-channel slips and one embayment at T4, proceeding upstream as follows (Figure 1):

- **Slip 1 (19.2 acres).** Slip 1 is an inactive slip with no existing water-dependent use, and none anticipated in the future. In the draft feasibility study (FS), U.S. Environmental Protection Agency (EPA) mistakenly assumed that Slip 1 was an active navigation area and subject to propwash forces, which it is not. EPA proposed Slip 1 for a confined disposal facility (CDF) capable of containing more than 670,000 cubic yards of contaminated sediment. A 60% Design Report was prepared and approved by EPA for this facility (Anchor QEA et al. 2011). However, the Port does not intend to pursue development of a CDF at T4.
- **Wheeler Bay (6.1 acres).** Wheeler Bay is an inactive bay with no existing water-dependent use, and none anticipated in the future. The Wheeler Bay shoreline was stabilized in 2008 as part of the T4 Early Action with habitat-friendly components (native riparian plantings, habitat substrate, and large woody debris) and more localized armor stone.
- **Slip 3 (14.1 acres).** On the north side of Slip 3, Berths 410 and 411 are the main site of active marine operations at T4. These are busy berthing areas with 80 percent vessel occupancy rate. Industrial marine terminal operations will continue at Berths 410 and 411 into the foreseeable future with ongoing Port control over tenant land use.

1.2 Terminal 4 Contaminants of Concern

EPA has identified polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) as the focused contaminants of concern at T4 (EPA PP Figure 20). A brief description of the PAH and PCB contamination at T4 is described in this section.

1.2.1 PAH Contamination

PAH contamination has been the focus of much of the investigation and remediation work conducted at T4 to date, including the Sediment Remedial Investigation (Hart Crowser 2000), the Engineering Evaluation/ Cost Analysis (EE/CA; BBL 2005), and the Early Action (Anchor Environmental et al. 2008; Anchor QEA et al. 2009). Historically, PAH contamination in Slip 3 and Wheeler Bay was derived from two principal sources: offloading of pencil pitch (a solid hydrocarbon product used in the aluminum industry) in Slip 3, and fuel seepage (including diesel and bunker C type fuels) associated with a former Union Pacific Railroad (UPRR) fuel pipeline along the head and southern peninsula of Slip 3 that once connected a fuel dock on the river to a former tank farm on the uplands east of Slip 3. Pencil pitch unloading at T4 ceased in 1998, and soil and groundwater contamination associated with the former fuel pipeline has been controlled through various source control actions on the uplands and banks of the slip (see Section 2.1).

1.2.2 PCB Contamination

In contrast to PAHs, the majority of the PCB contamination at T4 is found in two isolated locations, each represented by a single sample collected in 2004: surface sample T4-VC13 (820 micrograms per kilogram [$\mu\text{g/kg}$]) at 0 to 1 foot depth on the southwest slope of Slip 1 (EPA FS Figure 1.2-6a), and subsurface sample T4-VC29 (1,000 $\mu\text{g/kg}$) at 1 to 3 feet depth in the southeast part of Slip 3 (EPA FS Figure 1.2-6b). The subsurface PCB contamination in T4-VC29 is already covered by a foot of relatively clean material (42 $\mu\text{g/kg}$), providing evidence of sediment stability and natural recovery at this location.

These anomalous and isolated PCB concentrations decrease by an order of magnitude or more in all directions, spatially between these samples and their neighbors (25, 32, 36, and 5 $\mu\text{g/kg}$ PCBs in surface samples adjacent to T4-VC13; and 53 and <10 $\mu\text{g/kg}$ PCBs in surface samples adjacent to T4-VC29), and vertically between adjacent core intervals (37 $\mu\text{g/kg}$ in T4-VC13; 24 and 42 $\mu\text{g/kg}$ in T4-VC29). The T4 surface-weighted average concentration (SWAC) is relatively low (80 $\mu\text{g/kg}$), due to generally low PCB concentrations overall and a large percentage of undetected results. Thus, the PCB contamination has little or no continuity, and appears to be associated with relatively small historical sources that are limited in space and time, although the exact sources are unknown.

The two samples with anomalous PCB concentrations were collected 12 years ago in 2004, and they are not likely representative of current site conditions. Additional data needs to be collected during pre-Remedial Design (pre-RD) to determine whether the elevated PCB concentrations are still present, and if so, to better delineate the extent of these localized deposits and determine an appropriate remedial response (see Section 6.2).

2 SITE STATUS AND CONDITIONS

This section summarizes the various lines of evidence that indicate stable sediment conditions prevail throughout a majority of T4. Prior source control and sediment remediation/removal actions that have been implemented by the Port under Oregon Department of Environmental Quality (DEQ) and EPA oversight, respectively, are also described. The Port has been proactively addressing sediment contamination and upland source control issues at T4 for more than 20 years, culminating with the T4 Early Action in 2008 (Anchor QEA et al. 2009).

2.1 Sediment Stability

A strong weight of evidence indicates sediment conditions throughout much of T4 are stable and are not being dispersed into the mainstem river or subjected to downstream migration, as described in Appendix B1 to this report. Stable sediment conditions at T4 indicate contaminants are reliably contained within the terminal area, supporting the use of in-place remedial technologies, such as reactive capping, sand capping, in-situ treatment (i.e., activated carbon application), enhanced natural recovery, and natural recovery. Where needed, in limited areas, additional stability can be engineered to withstand temporary, local erosive forces.

The lines of evidence supporting stable sediment conditions at T4 include the following (see Appendix B1):

- **Quiescent Depositional Conditions.** River currents are attenuated in the off-channel waterways of T4, encouraging deposition and natural recovery, evidenced by mudline accretion between successive bathymetric surveys, low velocities in current meter records, prevailing fine-grained sediment textures, and relatively mature benthic communities.
- **Limited Propwash Effects.** Vessel propwash effects are spatially limited to the areas on the north side of Slip 3, primarily Berths 410 and 411 and the vessel approach lane to these berths, and are temporally limited to approximately 1-hour berthing maneuvers, with short bursts of power lasting only a few minutes. After the

propwash disturbance passes, any resuspended sediments will be deposited near their place of origin and retained within the slip.

- **Stable Sediment Slopes.** According to EPA's Multi-Criteria Decision Matrix (EPA FS Figure 3.4-16), the waterway floors are gently sloping and amenable to all forms of in-place remediation, and on the steep, riprapped terminal side slopes, dredging is likely infeasible.
- **Limited Potential for Sediment Disturbance.** Various potential sediment disturbance mechanisms, including extreme flood events, wind and vessel waves, earthquakes, and construction activities, can be shown to have limited potential for remobilizing contaminants at T4.
- **Proven Track Record.** Through the Early Action and other recent dredging projects, the Port has shown that dredging of contaminated sediments can be accomplished while maintaining compliance with water quality standards, and furthermore, the contaminants at T4 have poor solubility and bioavailability even if they become suspended in particulate form.

2.2 Completed Source Control Actions

The Port has been working with DEQ on upland source control measures for more than 20 years (DEQ 2007, 2010). In particular, much work has been done to control diesel and oil contamination associated with a pipeline connecting the former UPRR fuel tank, located east of the Slip 3 property, to a former fuel dock on the river (ECSI Site No. 272). DEQ concludes: "...the groundwater remedy appears to be successful, and the sediment recontamination potential due to groundwater at the site is low" (DEQ 2016).

EPA's depiction of an active groundwater plume discharging to the head of Slip 3 is inaccurate (EPA FS Figure 1.2-19). This plume has been controlled as a result of the following soil and groundwater source control actions (DEQ 2007, 2010, 2016):

- **1993.** An "interim" groundwater and nonaqueous phase liquid (NAPL) extraction system was installed at the head of Slip 3 and is still in operation.
- **1998.** The abandoned UPRR fuel pipeline on the southern peninsula of Slip 3 was drained and removed.

- **2004.** Contaminated riverbank soil at head of Slip 3 was excavated, and a reactive cap amended with organoclay was placed over the excavated soil surface to control diesel seepage associated with the former UPRR pipeline, as part of the Bank Excavation and Backfill Remedial Action (BEBRA) project (BBL et al. 2005).
- **2008.** As part of the T4 Early Action, the reactive cap at the head of Slip 3 was extended from the uplands down the bank and into the water, and protected with armor rock.
- **2009.** Upland soil hot spot removal actions were completed.
- **2008-present.** The Early Action cap continues to be routinely monitored (Anchor QEA 2016b), and no sheen has been observed at the head of Slip 3 since the upland and in-water reactive caps were installed.

In addition, the Port has implemented various stormwater source control measures at T4, including pipeline cleaning of high-risk drainage basins, increased street sweeping, impervious surface removal, and installation of a StormFilter vault with treatment cartridges containing zeolite, perlite, and granular activated carbon (Ash Creek 2011; Apex 2013). As a result: *“DEQ considers the stormwater pathway at the site controlled, pending effectiveness demonstration, and the sediment recontamination potential is low”* (DEQ 2016).

2.3 Completed Sediment Remediation and Removal Actions

In the water, the Port has implemented a number of sediment remediation and removal actions over the last few decades, primarily in Slip 3, to reduce site risks associated with contaminated sediments, as well as navigational dredging projects that simultaneously resulted in contaminated sediment removal. The history of sediment remediation and removal actions at T4 includes the following:

- **1984.** The Port dredged approximately 5,000 cubic yards of in-fill material from the pencil pitch unloading berths (Port of Portland 1992).
- **1993 – 1995.** In 1993, the Port entered into a Consent Decree with the United States (Port of Portland et al. 1993), and in 1995, the Port removed 35,000 cubic yards of contaminated sediment from Slip 3 (Port of Portland 1995a,b).

- **1997.** The Port removed 5,400 cubic yards of sediment from around the pencil pitch unloading berths as part of a maintenance dredging action (Port of Portland 1998a,b).
- **1998.** Hall-Buck (now Kinder Morgan) undertook dredging in Slip 3 to remove pencil pitch spilled on June 18, 1997. Pencil pitch loading at T4 was discontinued in this year (Hartman Consulting Corporation 1998).
- **2002 to 2005.** The Port removed approximately 4,750 cubic yards of contaminated sediment from Berths 410 and 411 during maintenance dredging projects. In addition, 2,700 cubic yards of contaminated sediment below the ordinary high water mark was removed as part of the BEBRA project (BBL et al. 2005).
- **2008 Early Action.** As part of the T4 Early Action, performed under an Administrative Order on Consent with EPA (EPA 2003, 2006), approximately 12,819 cubic yards of contaminated sediment were removed from Slip 3; reactive cap, sand cap, and sand cover were placed at the head of the slip; and the Wheeler Bay shoreline was stabilized. Because the remedial action objectives (RAOs) and preliminary remediation goals (PRGs) had not yet been established for the greater Portland Harbor, these actions were completed as part of an initial abatement measure (Phase I), and any follow-up actions that might be needed (Phase II) were deferred until after the issuance of the Portland Harbor Record of Decision (ROD). The contaminant reductions effected by the Early Action Phase I work are shown in Figure 2, which compares the sediment quality conditions in Slip 3 before and after Early Action construction. The remedial components of the Early Action are shown in Figure 3b.
- **2013.** The Port removed approximately 5,500 cubic yards of material during maintenance dredging actions at Berth 410 (Hart Crowser 2012; PSET 2012). The outer two thirds of the dredge prism at Berth 410 was deemed suitable for open-water disposal, while the inner third of the dredge prism exceeded screening levels of the Sediment Evaluation Framework (SEF), the dredging guidance for the Pacific Northwest (USACE et al. 2009). After a 6-inch sand cover was placed over the inner portion of the exposed dredge cut, PCB concentrations were below the EPA removal action level (RAL) of 200 µg/kg, and all other contaminants (PAHs, metals, DDT isomers, semivolatile organics) were below SEF screening levels. Thus, no active remediation is needed at this berth.

3 EPA'S PROPOSED REMEDY FOR TERMINAL 4

EPA's preferred remedial alternative for T4 is illustrated in Figure 3a. Although a detailed breakdown is not provided in the Proposed Plan or FS, EPA's preferred alternative for T4 appears to include dredging approximately 105,000 cubic yards and capping approximately 1.5 acres (Anchor QEA 2016a).

EPA's remediation costs for T4 were estimated from EPA's unit costs and generalized maps of dredging depths and extents. Using EPA's cost estimating methods, the cost of performing this remedy would be approximately \$32 million (Formation Environmental, 2016). Analysis by the Lower Willamette Group demonstrates that EPA's methods significantly underestimate remediation costs, and the true cost of EPA's proposed cleanup at T4 would realistically be \$62 million (Anchor QEA 2016a).

3.1 Basis for Proposing Alternative to EPA's Proposed Remedy

EPA's proposed remedy does not adequately account for site-specific conditions. It is based on a chain of harbor-wide decisions that emphasize removal of contaminated sediment rather than accurate analysis of risks and appropriate site-specific risk management decisions.

The Port's optimized remedial alternative for T4 would correct the main deficiencies of EPA's alternative, which are listed below and described further in subsequent sections of this appendix:

- Application of human health direct-contact exposure scenarios that are inapplicable at T4 because of Port site management and security protocols implemented pursuant to federal law (see Section 4)
- Inappropriate use of generic benthic risk criteria that do not reliably predict toxicity at T4, where remaining PAHs may be associated with either fuel (diesel and bunker C) or an unusual solid-phase hydrocarbon product (pencil pitch) with low bioavailability (see Section 5)
- Specification of prescriptive, dredging-focused removal action based on two isolated, unconfirmed, and outdated PCB detections (see Section 6)

- Incorrect assumptions regarding terminal navigation requirements, leading to an overemphasis on dredging technology (see Section 7)
- Specification of dredging actions that are not implementable because they will undermine and destabilize critical side-slopes, terminal structures, and previously placed sediment caps and shoreline stabilization measures (see Sections 3.2 and 7)

3.2 Incompatibility with Early Action

EPA's proposed remedy is not compatible with prior remediation work performed during the T4 Early Action in 2008. The proposed alternative would compromise remedial elements that have already been placed at the site, as well as critical stabilizing terminal structures.

EPA's remedial approach at T4 is compared to the constructed elements of the Early Action in Figures 3a and 3b, respectively. EPA's proposed remedy would do the following:

- Destroy or undermine a large part of the cap that was installed at the head of Slip 3 to control the former diesel seep
- Undermine the timber pinch-pile bulkhead at the head of Slip 3, and the steel sheetpile support along the base of Berth 411
- Prescribe dredging in areas that were just dredged in 2008 and 2013 (Anchor QEA et al. 2009; PSET 2012), without adequate consideration of current conditions
- Destabilize the stabilized shoreline in Wheeler Bay

The final remedy must build on the successful work that has already been completed at T4, not deconstruct it.

3.3 Terminal 4 Risk Pathways Driving Remedial Decisions

Table 1 provides a summary of the Portland Harbor RAOs, EPA's PRGs, and T4 SWACs. This table also includes a description of how each RAO is fulfilled by the Port's optimized alternative remedy, as described in Section 7 of this report.

3.3.1 Risk Drivers Identified by EPA

The main RAOs and associated risk drivers identified by EPA are as follows:

- RAO 1 – Protection of humans from direct contact and ingestion of site sediments containing carcinogenic PAHs (cPAHs)
- RAO 2 – Protection of humans from consumption of fish and shellfish that have accumulated PCBs from site sediments
- RAO 5 – Protection of benthic organisms from direct contact and ingestion of site sediments contaminated with chlordane, lindane, and various other chemicals

Although a detailed cost breakdown is not provided in EPA's Proposed Plan or FS, it appears that approximately 80 to 90% of the remediation cost is associated with reducing direct-contact and ingestion risks to fishers from cPAHs (RAO 1). The remainder of the remediation cost at T4 is allocated to reducing fish consumption risk from PCBs. Although EPA identified areas of benthic risk at T4, it does not appear that protection of benthic organisms factored into EPA's remedial decisions in any substantive way. EPA appears to have largely disregarded its own benthic risk analysis because it resulted in the attribution of benthic risk to the wrong chemicals and delineation of unreliable and unmanageable remediation areas (see Section 5.1).

EPA's proposed remedy does not apply risk management principles to efficiently or cost-effectively address actual site risk. The direct contact scenarios that are triggering remediation under RAO 1 do not exist at this secure marine terminal facility (see Section 4 and Appendix B2). EPA's benthic risk evaluation has deviated from the approved Baseline Ecological Risk Assessment (BERA) (LWG 2012, 2013b) and contains numerous deficiencies that render it unreliable (see Section 5). And the isolated PCB deposits that are triggering remediation under RAO 2 are based on two dated and unconfirmed sampling results (see Section 6).

3.3.2 Accurate Assessment of Risk Drivers at Terminal 4

There is no human health risk associated with direct contact and ingestion of PAH-contaminated sediment at T4 (RAO 1), as discussed in Section 4 of this report (see also

Table 1). The primary remaining risk driver at T4 is benthic toxicity associated with PAH contamination in Slip 3 (RAO 5). However, benthic risk is not reliably characterized in EPA's analysis, as described in Section 5 of this report, so the Port is proposing an alternative approach. Human health risk via fish consumption (RAO 2) is associated with two isolated occurrences of PCBs that need to be confirmed with additional pre-RD sampling before remedial decisions can be made, as discussed in Section 7 of this report.

EPA assumes that acceptable harbor-wide surface water quality (RAOs 3 and 7) will be achieved once harbor sediments are remediated, and progress toward these goals has already been made at T4 through the implementation of the Early Action and other sediment removal actions. Groundwater discharges to surface water and sediment (RAOs 4 and 8) have been controlled at T4, as described in Section 2.2. Controlling human health risk via fish consumption will implicitly control bioaccumulation pathways for ecological receptors as well (RAO 6). EPA did not identify any contaminated riverbanks at T4 (RAO 9; see EPA FS Figure 3.8-9c). However, DEQ determined: "*There are two additional areas of potentially erodible soil containing PAHs along the south bank of Slip 3 and the east bank of the Willamette River south of Slip 3. Due to considerations of cost and efficiency, the Port proposes to address these areas at the time of EPA's in-water remedy*" (DEQ 2016). Therefore, the Port plans to further evaluate these two small areas of bank contamination during pre-RD.

4 HUMAN HEALTH DIRECT CONTACT/INGESTION RISK (RAO 1)

This section outlines the Port's concerns with EPA's assessment of human health direct contact/ingestion risk at T4, and the ineffectiveness of EPA's resulting remedial decisions. EPA's assessment of risk associated with direct contact and ingestion of sediment is based on exposure assumptions that do not exist at T4. When actual site-specific exposures are considered, it can be shown that there is no reasonable risk via this pathway.

4.1 EPA's Risk Scenarios

The key receptors in EPA's analysis of direct contact/ingestion risk include the following, in order of their frequency and magnitude of exposure:

- Tribal fishers
- High-frequency fishers
- Divers in wet suits
- In-water workers

EPA's calculated PRGs for these direct-contact exposure pathways are compiled in Table 1, along with the T4 SWACs for carcinogenic PAHs and PCBs.

Note that the T4 SWACs are less than the PRGs for in-water workers, indicating no unacceptable risk to in-water workers at T4. Therefore, in-water workers will not be discussed further.

In the EPA-approved Baseline Human Health Risk Assessment (BHHRA; LWG 2013b), neither recreational nor transient beach use was determined to be an applicable exposure scenario at T4. However, in the Proposed Plan (EPA 2016b), EPA's assumptions regarding beach use at T4 are unclear, and the application of PRGs for beach users appears to be inconsistent with the Draft Final FS (EPA 2016a). In any case, recreational and transient beach users are not viable receptors at T4 because access from the uplands is prevented at this gated and secured facility, and waterside access is prevented because vessels are not allowed to tie up at T4 docks or structures (see Appendix B-2). Moreover, the T4 shoreline consists mainly of steep, riprapped slopes. EPA should therefore state clearly that recreational beach use is not applicable at T4, consistent with the approved BHHRA.

4.2 Fishers and Recreational Divers

EPA assumes that tribal fishers will fish 260 days per year at T4 (i.e., 5 days per week, every week), for an entire 70-year lifetime, and every time the fisher will fully cover his hands and forearms with sediment from T4 through the handling of anchors or fish hooks, and will ingest approximately 4 pounds (approximately 2 quarts) of sediment from T4 over the course of his lifetime. EPA assumes that high-frequency fishers will fish 156 days per year at T4 (i.e., 3 days per week, every week), for 30 years, and every time the fisher will fully cover his hands and forearms with sediment from T4 through the handling of anchors or hooks, and will ingest approximately 1 pound (approximately 1 pint) of sediment from T4 over the course of his lifetime. Diver exposures are discussed in Section 4.3.

It should be noted that EPA modified, without explanation, certain direct contact/ingestion parameters from the values that were previously approved in the BHHRA (LWG 2013a). For example, the incidental sediment ingestion rate was increased from 50 to 100 milligrams per day (mg/day), and the site use factor was increased from 25 to 100%. EPA's modifications increase the *perceived* risk but do not provide a reasonable representation of the actual risk at T4. In addition, EPA makes no allowance for ongoing natural recovery of sediments over the 30- to 70-year exposure durations of these fishers, even though comprehensive source controls are in place.

Notwithstanding EPA's unrealistic exposure scenarios, and the deviations from the risk assumptions in the approved BHHRA, meaningful direct-contact exposures to fishers and recreational divers do not occur at T4 because the Port operates an active, secure marine terminal facility. Public access to T4 for fishing or recreational diving is prevented by maritime safety and security measures implemented by the Port, as described in Port Comments and Appendix B2 of this report.

If de minimis, isolated incidents of fishing did occur at T4, they would pose no unacceptable human health risk. Even accepting EPA's unreasonably high exposure assumptions regarding site use, incidental ingestion rate, and skin contact area, a person could fish 6 days per year for 70 years, or 420 days in the fisher's lifetime with no unacceptable risk. If more

reasonable values are assumed for these exposure parameters, substantially more days of fishing at T4 would pose no risk. For example, if the fisher covered his hands with sediment each time he fished through the handling of hooks and anchors (not full coverage of hands and forearms), and ingested sediment at the rate used in the approved BHHRA (50 mg/day) rather than EPA's increased rate (100 mg/day), and fished at T4 for 30 years rather than 70 years, then one could perform fishing at T4 more than 25 days per year with no unacceptable risk (Kennedy/Jenks Consultants, 2016). This would be 750 days in the fisher's lifetime with no unacceptable risk.

4.3 Commercial Divers

EPA assumes that commercial divers will dive in a wet suit 5 days per year for 25 years (i.e., 125 dives at T4), and each time the diver's entire body will be in contact with sediment, and the diver will ingest about a teaspoon of sediment from T4 during the course of his career. EPA required the evaluation of a wet suit diver scenario in the BHHRA (rather than a dry suit, which would provide a much more effective barrier to sediment contact) and has carried that scenario forward into the EPA FS.

Commercial divers are used very infrequently at T4, far less frequently than assumed by EPA. To the Port's best knowledge, the use of commercial divers in recent years has mainly occurred during remedial investigations and remedial actions at T4 (Port of Portland, 2016). In 2003, a diver was used to deploy sediments traps for the T4 EE/CA (BBL 2005), and in 2008, a diver in a *dry suit* was used to survey the recently placed cap at the head of Slip 3 (Anchor QEA et al. 2009). If EPA's exposure assumptions were reduced by only 20% (i.e., 100 total career dives rather than 125), there would be no unacceptable risk to divers in wet suits at T4. In reality, the frequency of commercial diver exposures at T4 will be at least an order of magnitude less than EPA's assumption. Although there are no plans for any extended dive work at T4, if such work is ever conducted, diver exposures can be effectively managed using site-specific Health and Safety Plans.

5 RISK TO BENTHIC ORGANISMS (RAO 5)

The risk to benthic organisms from contact with T4 sediments was substantially curtailed as a result of the 2008 Early Action, as shown in Figure 2. Nevertheless, the Port recognizes that there may be residual risks to benthic organisms associated with PAH contamination, in particular at Slip 3.

EPA's analysis of benthic risk, however, is well off the mark. The Port's concerns with EPA's approach are described in this section, and a proposed solution is provided.

5.1 EPA's Benthic PRGs Are Unreliable

EPA's analysis of benthic risk contains a number of deficiencies that render it unreliable and incongruous with existing site chemical and biological data obtained during the T4 Remedial Investigation (RI), EE/CA, and Early Action investigations, as well as contradictory to the agreed-upon methods and conclusions of the BERA (LWG 2013a). Although a substantial effort was made to quantify reliability metrics for different benthic risk criteria as part of the BERA, EPA's misapplication of the criteria has invalidated the metrics and degraded their reliability. The deficiencies in EPA's benthic risk analysis include the following:

- **Single Line of Evidence.** It is well accepted (e.g., Wenning and Ingersoll 2002; MacDonald et al. 2000) that benthic risk is best evaluated using multiple lines of evidence, like the approach used in the approved BERA (LWG 2013a; Windward 2016). EPA has oversimplified the benthic risk analysis down to a single line of evidence—the lowest available sediment quality values—by inappropriately combining multiple lines of evidence and disregarding others.
- **Biased Selection of Benthic PRGs.** EPA selected the lowest available values from the floating percentile model (FPM) and the logistic regression model (LRM), and in some cases, the lowest value among competing LRM models, then appended a few Probable Effects Concentrations (PEC). This is a statistically biased approach—consistently picking the lowest value from a group of possible values—which results in a hodgepodge of benthic indicators derived using disparate methods, and inflated prediction errors. This also contradicts previous agreements about how these data should be used: “*EPA and the LWG recognize that the sediment quality guidelines*

produced by any model (LRM, FPM, or generic SQGs such as PECs or PELs) are intended to be used as a set – not individually” (Windward 2016).

- **Misapplication of PRGs.** EPA *un*-normalized LRM values using site-wide mean organic carbon and percent fines values. However, the LRM values should be applied in their original normalized units. The Washington State Department of Ecology, which has been using carbon-normalized benthic values in its marine Sediment Management Standards for many years (WAC 173-204-320) would not condone such an inappropriate simplification (Ecology 2015). By *un*-normalizing the values, EPA is removing important site-specific information and undermining their reliability.
- **Misuse of Undetected Values.** EPA made no distinction between detected and undetected concentrations in their benthic risk analysis. As a result, a handful of undetected results with elevated detection limits from older analytical methods are driving EPA’s benthic risk at T4. For example, EPA concluded that chlordane (FS Figure D11-1b) and lindane (FS Figure D11-1j) are substantial components of the benthic risk at T4, when in fact, lindane has never been detected at T4, and chlordane has never been detected above benthic PRGs.
- **Unsupported Factors Applied to PRGs.** EPA’s inappropriate derivation and use of benthic PRGs incorrectly implicates a large majority of the harbor for unacceptable benthic risk (FS Figure 4.1-1). To reduce the size of the effective remediation areas, it appears EPA selected and applied a factor of 10 to the benthic PRGs (10x PRG). Based on the adjusted PRGs, EPA evaluated remedy performance as acceptable if the remedy provides 50% coverage of the 10x PRG areas. EPA does not provide any rationale for applying these factors to the PRGs, nor is it clear what actual level of risk reduction is being achieved by this approach.

5.2 The Port’s Proposed Solution

The most reliable estimates of benthic risk currently available in Portland Harbor are the Lower Willamette Group’s Comprehensive Benthic Risk Areas (CBRA; LWG 2012), which were delineated based on a weight-of-evidence approach utilizing information from a variety of benthic data sets, including sediment, porewater, and bioassay tests. The CBRA for T4 affects the inner portion of Slip 3, as shown in Figure 3b. This is consistent with bioassay testing results from the T4 RI, which similarly found that the more significant benthic

toxicity was in the head of the slip (Hart Crowser 2000). In marked contradiction, due to the deficiencies described in Section 5.1, EPA mistakenly assigned the highest benthic risk to the *outer* portion of Slip 3 (FS Figure 4.2-29).

A large part of the CBRA overlaps with prior dredging and capping work completed during the Early Action, as shown in Figure 3b. Thus, the current conditions in this area should be re-characterized and targeted for further evaluation during pre-RD investigation. Because pencil pitch could be a source of remaining contamination and has been shown to have significantly reduced bioavailability compared to other more common sources of PAH contamination (Hart Crowser 2000), generic harbor-wide chemical criteria will not reliably identify risk at T4, and chemical data should be supplemented with more direct measurements of site-specific toxicity. Until these site-specific measurements are completed, benthic risk areas cannot be accurately delineated, and appropriate remedial response actions cannot be selected.

6 HUMAN HEALTH FISH CONSUMPTION RISK (RAO 2)

The risk associated with RAO 2 is mainly derived from two isolated PCB results, one in Slip 1 and the other in Slip 3, as described in Section 1.2.2. The two locations with elevated PCB results are shown in Figure 3b, as well as EPA FS Figures 1.2-6a and 1.2-6b. The PCB anomaly in Slip 1 is at the surface, whereas the PCB anomaly in Slip 3 is already buried by a foot of relatively clean surface sediment, indicating minimal current risk to the waterway, and providing evidence for sediment stability and ongoing natural recovery in that area.

6.1 Implementability Concerns with EPA's Remedy

EPA's prescriptive use of dredging to address the PCB anomalies at T4 has poor implementability and conflicts with local site conditions. The PCB anomaly in Slip 1 is located on a steep (approximately two-to-one) and partially riprapped slope, and the PCB anomaly in Slip 3 is located at the base of an armored, reactive cap placed at the head of Slip 3 during the Early Action. Unconstrained dredging of these areas would be geotechnically and environmentally risky, as well as costly. On the other hand, both areas are in protected off-channel locations, outside active navigation lanes, and are likely suitable for less disruptive, in-place remedial technologies, such as sand capping, reactive capping, activated carbon treatment, enhanced natural recovery, and/or monitored natural recovery.

6.2 Pre-Design Data Are Needed

The extent of the two localized PCB anomalies at T4 is not sufficiently well defined at the present time to determine an appropriate remedial response. Additional pre-RD data are needed to determine whether the elevated PCB concentrations are still present and reproducible in the southwest margin of Slip 1 and the southeast corner of Slip 3, and if so, to better delineate the three-dimensional extent of these deposits. The analytical results are now more than 12 years old and are no longer representative of current site conditions.

6.3 The Port's Proposed Solution

The information currently available is not sufficient to support remedy selection decisions regarding PCBs and fish consumption risk in the two limited areas of PCB contamination at T4. Flexibility must be maintained during remedial design to implement the Port's

recommended pre-RD PCB delineation study and to better tailor the remedy to be compatible with site conditions and side-slopes, including the Early Action cap at the head of Slip 3 (see Section 7). Because both areas are outside active navigation lanes, and dredging may be constrained by slope stability concerns, a range of remedial technologies will need to be evaluated during Remedial Design.

7 THE PORT'S OPTIMIZED ALTERNATIVE REMEDY

The Port's optimized alternative remedy is summarized in Figure 3b. The Port proposes to implement a more balanced application of remedial technologies that would provide optimal risk reduction while accommodating site-specific navigation requirements, structural constraints, and slope stability concerns. In contrast, EPA proposes an overly aggressive dredge-centric approach that does not accommodate site-specific conditions and constraints at T4. An optimized blend of dredging, reactive capping, sand capping, and residual sand covers was successfully implemented during the Early Action. The final remedy needs to follow a similar approach.

Other advantages of the Port's proposed alternative include the following:

- The Port alternative will be designed to complement and build on the successful remedial components that were implemented during the Early Action, rather than undermine or deconstruct them.
- The Port alternative will be designed to reduce actual risk at the site, rather than illusory risk based on inapplicable human health direct contact exposure assumptions or unreliable benthic PRGs.
- The Port alternative will allow remedial decisions to be informed by important pre-RD investigations that would be strategically designed to better characterize current site conditions and sediment toxicity, leading to a remedy that will more cost-effectively address site risk.

7.1 Remedy Flexibility during Remedial Design

Design flexibility is a critical component of the Port's alternative approach to sediment remediation at T4. EPA cannot be expected at this stage to be familiar with all of the nuances of the current site conditions, navigational requirements, structural constraints, and the status of remediation and source control actions at T4. Many of the deficiencies in EPA's proposed remedy are related to the application of prescriptive, harbor-wide decision criteria that do not make sense for site-specific application. As a result, it is imperative that flexibility is retained during Remedial Design to allow modification of technology

assignments that are better tailored to site conditions, informed by pre-RD investigations, and optimized to more effectively control site risk.

Flexibility is needed to incorporate the results of important pre-RD investigations that are being recommended by the Port. These include the following:

- PCB delineation study to verify and refine the extent of elevated PCB detections at two isolated locations (see Section 6.3)
- Benthic toxicity study to characterize the site-specific risk to benthic organisms associated with PAHs derived from historical pencil pitch and fuel sources (see Section 5.2)
- Characterization of current conditions in Wheeler Bay and along the southern bank of Slip 3, areas that were once envisioned to be part of a Phase II Early Action (Anchor QEA and NewFields 2010), but will need to be reevaluated in consideration of the approved BHHRA (LWG 2013b) and BERA (LWG 2013a), and the proposed Portland Harbor PRGs and RALs
- Additional geotechnical studies to ensure that the remedy will not destabilize marine terminal structures, waterway side slopes, or the remedial components of the Early Action

During Remedial Design, Port operations staff will also need to determine navigation requirements for existing and likely future uses of the terminal.

7.2 Requested Changes to Record of Decision

The Port requests that EPA make the necessary revisions to the ROD to allow the Port to pursue its proposed alternative remedy for T4, thereby ensuring that remediation resources will be used to effectively and efficiently reduce actual site risk. EPA needs only to make a few changes to the ROD to enable this optimized alternative remedy at T4:

- **Human Direct Contact Risk.** The Port requests that EPA make a site-specific risk management decision in the ROD that human direct contact risk is inapplicable to remedy selection and design at T4 because the Port's site management and security

protocols constitute governmental and institutional controls that prevent public access.

- **Benthic Risk.** In its discussion of RAO 5, EPA should add a statement that benthic PRGs can be supplemented by site-specific toxicity studies, such as bioassay tests, and these site-specific studies would take precedence over generic, harbor-wide benthic PRGs.
- **Design Flexibility.** EPA should make it clear that the ROD will allow flexibility to modify remedial technology assignments and footprints during Remedial Design to address site risk more efficiently, to better accommodate site uses and constraints, and to incorporate important pre-RD investigation results.

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Table 1
Summary of Terminal 4 Risk Drivers

Remedial Action Objective		Receptor	EPA PRG (µg/kg)			Terminal 4 Notes
			cPAH	Total PAH	Total PCB	
Human Health RAOs	1	Direct Contact/ Ingestion of Sediments	Tribal Fisher	106	369	[1] Tribal fishers, high-frequency fishers, and recreational divers are not valid receptors at T4 (see Section 4). Commercial diver exposures are much more limited than EPA assumptions and can be controlled using appropriate Health and Safety Plans, as necessary.
			High-frequency Fisher	411	1,435	
			Diver, Wet Suit	2,586	8,807	
			In-water Worker	8,570	30,583	
	2	Fish/Shellfish Consumption	Subsistence Fisher	3,950	0.11 – 0.2	[2] There is no unacceptable risk for cPAH under existing conditions at T4. PCB risks are driven primarily by two isolated and dated samples in Slip 1 and Slip 3 (see Section 6 and Figure 3b). These localized deposits would need to be confirmed and further delineated during pre-Remedial Design.
	3	Direct Contact/ Ingestion of Surface Water	Various Beneficial Uses for Humans	State and Federal Water Quality Criteria		[3] Surface water concentrations, exposures, and risks have been reduced through prior remedial actions and will be further reduced, as needed, through the final in-water action at T4.
	4	Groundwater Discharges to Surface Water and Sediment	Protection of Surface Water and Sediment Quality (DEQ Lead)	Protection of State and Federal Water Quality Criteria		[4] The Port has controlled sources of upland groundwater contamination through prior upland and in-water source control actions (see Sections 2.2 and 2.3).
Ecological RAOs	5	Direct Contact/ Ingestion of Sediments	Benthic Organisms	23,000	500	[5] EPA's benthic risk analysis contains numerous deficiencies (see Section 5.1). Notwithstanding those deficiencies, the Port acknowledges that some residual benthic risk may exist for PAHs that will be addressed through site-specific chemistry and toxicity testing during pre-Remedial Design.
	6	Consumption of Contaminated Prey	Fish, Birds, Mammals	N/A	36	[6] Ecological bioaccumulation is not a pathway of concern for PAHs. Controlling bioaccumulation of PCBs in humans will implicitly control the ecological pathway as well.
	7	Direct Contact/ Ingestion of Surface Water	Various Beneficial Uses for Aquatic Life	State and Federal Water Quality Criteria		[7] Surface water concentrations, exposures, and risks have been reduced through prior remedial actions and will be further reduced, as needed, through the final in-water action at T4.
	8	Groundwater Discharges to Sediment and Surface Water	Protection of Surface Water and Sediment Quality (DEQ Lead)	Protection of State and Federal Water Quality Criteria		[8] The Port has controlled sources of upland groundwater contamination through prior upland and in-water source control actions (see Sections 2.2 and 2.3).
Source Control	9	River Bank Discharges to Sediment and Surface Water	Protection of Surface Water and Sediment Quality	To Be Determined in Consultation with DEQ		[9] Riverbanks at T4 are steeply armored and engineered for marine terminal operations. A substantial portion of the T4 bank contamination has been previously addressed by DEQ source control actions (see Section 2.2). Two small areas of PAH contamination near the top of the bank at Slip 3 will be addressed as part of the final in-water remedial action (DEQ 2016).
Existing Terminal 4 SWAC (µg/kg):			3,224	21,640	80	

Notes:

µg/kg = micrograms per kilogram

cPAH = carcinogenic polycyclic aromatic hydrocarbon

DEQ = Oregon Department of Environmental Quality

EPA = U.S. Environmental Protection Agency

N/A = not applicable

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

PRG = Preliminary Remediation Goal

RAO = Remedial Action Objective

SWAC = surface weighted average concentration

T4 = Terminal 4

References:

[1] EPA FS Table B3-4

[2] EPA FS Table B3-5

[3] EPA FS Table 2.2-6

[4] EPA FS Table 2.2-7

[5] EPA FS Table B4-1

[6] EPA FS Table B4-2

[7] EPA FS Table 2.2-10

[8] EPA FS Table 2.2-11

[9] DEQ 2016

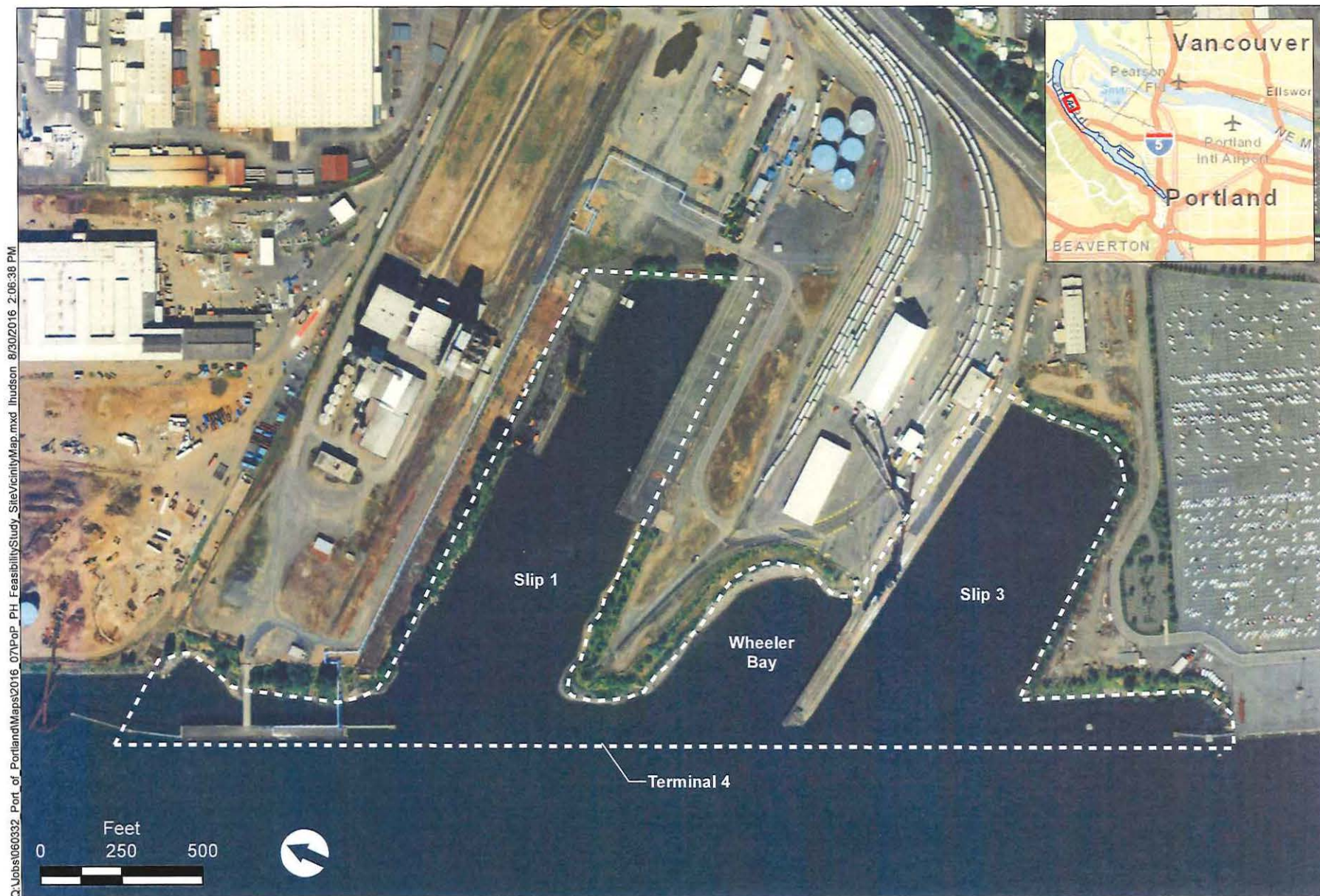
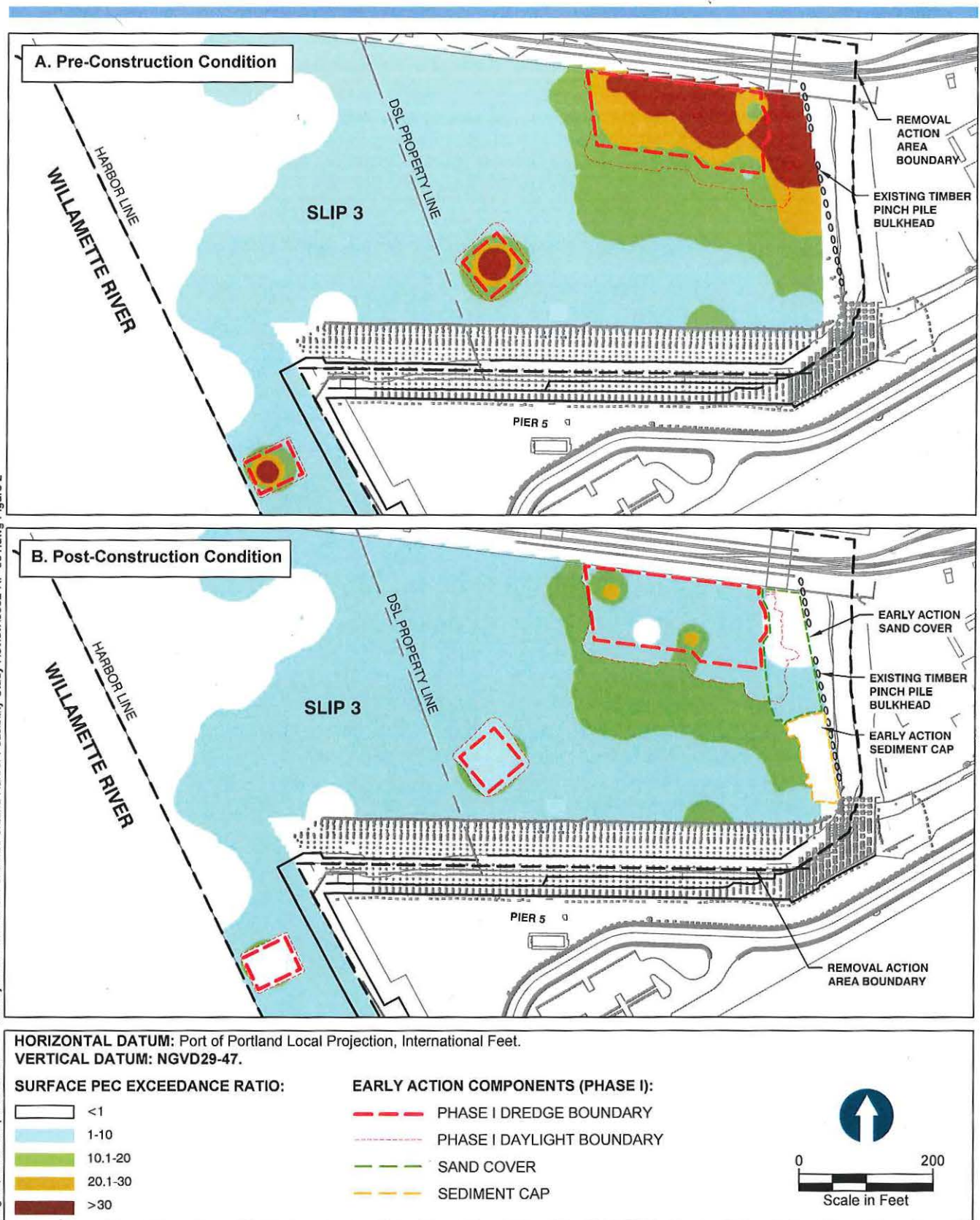


Figure 1
Terminal 4 Vicinity Map
Optimized Alternative Remedy for Terminal 4
Port of Portland

K:\Projects\0332-Port of Portland\Portland Harbor Feasibility Study Review\0332-RP-001.dwg Figure 2



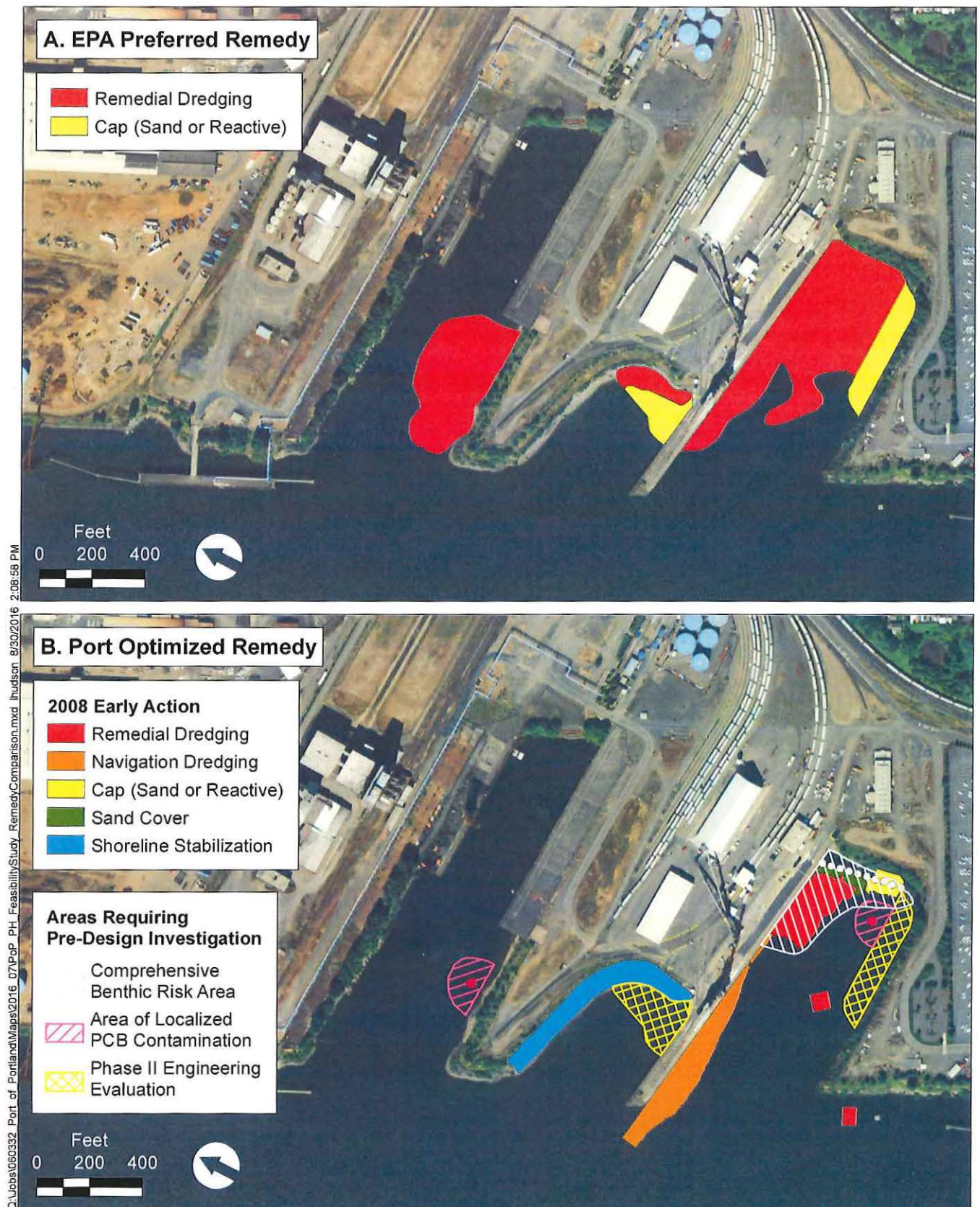


Figure 3
Terminal 4 Remedy Comparison
Optimized Alternative Remedy for Terminal 4
Port of Portland

APPENDIX B1
TERMINAL 4 SEDIMENT STABILITY
ASSESSMENT

TECHNICAL MEMORANDUM

To: Kelly Madalinski and Megan Decker, Port of Portland	Date: August 31, 2016
From: Todd Thornburg, Amanda Shellenberger, John Verduin, P.E., Anchor QEA, LLC	Project: 050332-01.25
Re: Terminal 4 Sediment Stability Assessment	

EXECUTIVE SUMMARY

The majority of sediments at Terminal 4 (T4) are physically and chemically stable, and where needed, in limited areas, additional stability can be engineered. As a result, the permanence and long-term effectiveness of in-place technologies (e.g., capping, in situ treatment, enhanced monitored natural recovery [EMNR], and monitored natural recovery [MNR]) is nearly identical to removal technologies (e.g., dredging) when applied at T4. In-place technologies can provide permanent remedies meeting all aspects of the National Contingency Plan short-term and long-term effectiveness criteria, with lower implementation risks and reduced greenhouse gas emissions. In-place technologies can be designed and implemented using accepted industry practices to provide physical stability to resist or accommodate any erosive forces that may be present, and chemical stability to securely contain or control any residual sediment contamination. Unfortunately, these technologies were not given their due consideration in U.S. Environmental Protection Agency's (EPA's) Feasibility Study (FS; EPA 2016a) and Proposed Plan (EPA 2016b).

The lines of evidence supporting stable sediment conditions at T4 include the following:

- **Quiescent Depositional Conditions.** River currents are attenuated in the off-channel waterways of T4, encouraging deposition and natural recovery, evidenced by mudline accretion between successive bathymetric surveys, low velocities in current meter records, prevailing fine-grained sediment textures, and relatively mature benthic communities.
 - **Limited Propwash Effects.** Vessel propwash effects are limited to the areas on the north side of Slip 3, primarily Berths 410 and 411 and the vessel approach lane to
-

these berths, and are limited to approximately 1-hour berthing maneuvers, with short bursts of power lasting only a few minutes. After the propwash disturbance subsides, any resuspended sediments will be deposited near their place of origin and retained within the slip.

- **Stable Sediment Slopes.** According to EPA's Multi-Criteria Decision Matrix (EPA Feasibility Study [FS] Figure 3.4-16), the waterway floors are gently sloping and amenable to all forms of in-place remediation. On the steep, riprapped terminal side slopes, dredging is likely infeasible.
- **Limited Potential for Sediment Disturbance.** Various potential sediment disturbance mechanisms, including extreme flood events, wind and vessel waves, earthquakes, and construction activities, can be shown to have limited potential for mobilizing sediments or contaminants at T4.
- **Proven Track Record.** Through the 2008 Early Action and other recent projects, the Port has shown that in-water construction can be accomplished while maintaining compliance with water quality standards. Furthermore, the contaminants at T4 have poor solubility and bioavailability even if they become suspended in particulate form.

1 T4 HYDRODYNAMIC CONDITIONS ARE SUITABLE FOR IN-PLACE REMEDIAL TECHNOLOGIES

River currents are greatly attenuated in the quiescent off-channel areas at T4, encouraging deposition and natural recovery processes. Such areas are suitable for application of in-place remedial technologies such as capping (with or without reactive amendments), in situ treatment, and natural recovery with or without sand cover enhancements.

1.1 Ambient Currents

Ambient currents are weak at T4, as evidenced by Acoustic Doppler Current Meter (ADCM) measurements collected at T4 during the Engineering Evaluation/Cost Analysis (EE/CA; BBL 2005, Appendix G). The ADCM data showed relatively strong currents in the mainstem Willamette River at the time of the survey in March 2004 (averaging 0.5 foot per second and peaking at 1.5 feet per second), and an abrupt transition to weak or negligible currents within the slips, approaching the measurement resolution of the current meter. The survey

identified a clockwise eddy in the outer portion of Slip 3 that likely induces sediments to eddy out of the mainstem river and deposit within the slip.

The normally quiescent environment in Slip 3 is periodically interrupted by short-lived propwash events during vessel docking at Berths 410 and 411, during which time bottom velocities of 0.3 to 1.6 feet per second have been observed (BBL 2004). Propwash effects in Slip 1 and Wheeler Bay are negligible due to a lack of vessel activity. It is noted that the EPA misidentified Slip 1 as an active navigation area susceptible to propwash, which it is not (EPA FS Figures 1.2-4b and 3.4-24). Propwash effects in Slip 3 are discussed further in Section 3.4.

1.2 Evidence of Sedimentation and Natural Recovery

Portland Harbor is predominantly a depositional environment, especially the area downstream of river mile 5, which includes T4 (Lower Willamette Group [LWG] Draft FS Section 6.2.2.1.1; LWG 2012). This is supported by multiple lines of evidence, including sediment trap deployments, multibeam bathymetry surveys, and radioisotope profiles in sediment cores. Depositional conditions are further enhanced at T4 as a result of the off-channel configurations and generally weak currents in the T4 waterways.

1.2.1 Net Deposition Is the Prevailing Condition at T4

Relatively clean and fine-grained sediments from the mainstem river tend to eddy out and deposit in the T4 waterways, contributing to ongoing natural recovery processes. Overall, T4 is net depositional, based on bathymetric changes from 2002 to 2009 (EPA FS Figure 3.4-19b). The main areas of mudline deepening during the survey period are associated with the 2008 Early Action, primarily centered on Berth 411, and the associated navigational dredging action at Berth 410. Consideration of these removal actions appears to have been omitted from EPA's sedimentation analysis. The mudline has accreted by approximately 1 to 4 centimeters per year in Slip 1 and Wheeler Bay. Outside of the active berthing areas, even higher sedimentation rates are observed in Slip 3, especially toward the interior of the slip.

The main exception to the overall depositional condition at T4 is the approach lane and berthing area for Berth 411, which is underlain by sand and subject to vessel propwash. Based on Remedial Investigation and EE/CA data (Hart Crowser 2000; BBL 2005), the sandy sediments in the vessel approach lane in the outer half of Slip 3 are likely nontoxic to benthic organisms. Berth 411 was the subject of the Early Action (Anchor QEA et al. 2009), which substantially improved surface sediment quality in that area. Propwash effects are discussed further in Section 3.4 and can be managed using appropriate engineering controls (see Section 5).

1.2.2 *Stratigraphic Evidence for Ongoing Sedimentation*

Fine-grained sediments tend to accumulate in quiescent areas. A majority of the surface sediments in T4 have 40% to 80% or greater fines content (EPA FS Figure 2.2-1). The median grain size at T4 is less than 50 microns (i.e., silt class; LWG Draft FS Appendix La, Figure 2-33).

Sediment cores at T4 (BBL 2004; Anchor Environmental et al. 2008) indicate 1 to 5 feet of fine-grained sediment (silt and silty sand) has accumulated over a sandy alluvial base layer in Slip 1, Wheeler Bay, and much of Slip 3, with even greater thicknesses accumulating in the interior of the slips. These stratigraphic profiles are consistent with a history of ongoing sedimentation following the development of these constructed waterways.

1.2.3 *Mature Benthic Communities in Sediment Profile Images*

Sediment profile image surveys conducted in 2001 and 2013 provide an assessment of the succession (or maturity) of the benthic infaunal community at T4 (Striplin 2002; Germano 2014). Following a sediment disturbance, the benthic community will typically progress from Stage 1 (initial colonization by opportunistic and rapidly reproducing surface feeders) to Stage 3 (mature community with larger, slower growing, and more deeply burrowing organisms). The prevalence of Stage 3 communities at T4 provides another independent line of evidence for sediment stability.

- In 2001, approximately half of the stations at T4 showed evidence of mature Stage 3 community structures. This included all of Slip 3, despite its active berthing
-

operations, and the inner portion of Slip 1. Wheeler Bay and the outer portion of Slip 1 were characterized as more immature Stage 1 communities.

- In 2013, mature Stage 3 community structures continued to inhabit Slip 3 and were expanded in Slip 1, whereas Wheeler Bay continued to show a more immature community. The benthic community in Wheeler Bay may be affected by more energetic wind and wave forces, as discussed in Section 3.3.
- Overall, from 2001 to 2013, there was a significant increase in the percentage of mature Stage 3 communities in Portland Harbor (from 46% to 71%). In addition to sediment stability, decreasing contaminant stressors may have also contributed to the maturation of benthic communities in the harbor, providing evidence of ongoing natural recovery.

2 TERMINAL 4 SEDIMENT SLOPES ARE SUITABLE FOR IN-PLACE REMEDIATION

The slopes at T4 are suitable for in-place remediation and are consistent with the application of EPA's technology decision criteria. Placement of a treatment cap on a relatively steep slope at the head of Slip 3 was successfully implemented during the Early Action. On the other hand, to the extent remediation may be needed on the steep, riprapped terminal side slopes, dredging is likely infeasible, and in-place technologies must be considered out of necessity.

The following table summarizes the observed sediment slopes at T4:

Area	Slope	Degrees
Slip One Floor	50:1 to 7:1	1 to 8
Wheeler Bay	50:1 to 6:1	1 to 10
Slip Three Floor	28:1 to 7:1	2 to 8
Head of Slip Three Cap	4:1 to 3:1	14 to 18
Terminal Side Slopes	2:1	27

2.1 Consistency with EPA's Technology Decision Matrix

Outside of the steep and heavily engineered terminal side slopes discussed in Section 2.3, all other slopes at T4 are amenable to all forms of in-place remediation, according to EPA's Multi-Criteria Decision Matrix (EPA Draft Final FS, Figure 3.4-16).

- >15-degree slope: No Unarmored Capping (or EMNR)
- >30-degree slope: No Capping

2.2 Successful Early Action Cap Installation

An armored treatment cap has already been successfully installed on 4:1 to 3:1 slope (14 to 18 degrees) at the head of Slip 3 during the 2008 Early Action. Ongoing cap monitoring efforts have detected no evidence of seepage from the former diesel seep, nor any downslope movement of armor material since the cap was installed (Anchor QEA 2016). The cap is therefore functioning as intended.

2.3 Most Terminal 4 Side Slopes Are Infeasible to Dredge

Terminal side slopes at T4 were typically engineered at approximately 2:1. Dredging is likely infeasible on or adjacent to most side-slope areas because removal can undermine and destabilize adjacent nearshore structures, such as terminal aprons, piers, and pilings. In addition, many of the side slopes are riprapped, which severely limits the application of dredging technology, as recognized in EPA's Multi-Criteria Decision Matrix.

3 POTENTIAL SEDIMENT DISTURBANCES CAN BE CONTROLLED

The potential for sediment disturbances from extreme floods, earthquakes, wind and vessel waves, vessel propwash, and in-water construction activities has been evaluated at T4. Sediment disturbances resulting from the first three types of events are expected to be minor or negligible. In the case of propwash and in-water construction activities, sediment disturbances cannot be completely prevented but can be controlled using appropriate engineering technologies or construction best management practices.

Any sediments resuspended by such disturbances, and their associated contaminants, are expected to be substantially retained within T4. Due to the lack of ambient currents in the

protected T4 waterways, resuspended sediments will fall back to the sediment bed close to their place of origin once the disturbance subsides. In addition, the eddy circulation in the outer portion of Slip 3 will tend to direct any resuspended sediments back into the slip.

3.1 Extreme Floods

T4 slips and embayments provide off-channel protection from mainstem river currents even during extreme flood events. No flood scour was predicted at T4 during a simulation of the 1996 Spring Flood event (likely a 100-year return period, or greater), and some deposition was even predicted in the mouth of Slip 3 (LWG Draft FS Appendix La, Figures 3-3 and 3-4, and EPA FS Figure 3.4-18).

3.2 Earthquakes

Ash Creek (2011) completed a detailed assessment of the seismic environment at T4 as part of the T4 Confined Disposal Facility 60% Design. This analysis included “mega-thrust” earthquakes along the Cascadia Subduction Zone and shallower crustal earthquakes along known or hypothetical faults.

- **Deformation of Waterway Floors.** Recent surface sediments, some of which may be contaminated, and the upper layers of underlying river alluvium may be subject to liquefaction during an earthquake. However, T4 contaminants are concentrated on relatively flat waterway floors where there is little or no gravitational driving force to displace them (see Section 2). As a result, there may be isolated areas of settlement and movement, but sediments should not move far from their original location within the slip and should not be released to the river.
 - **Deformation of Sediment Caps.** If T4 sediments were capped, the caps could be susceptible to liquefaction under certain seismic events, and similar responses are anticipated. On the relatively flat waterway floors, some cap thinning may occur due to consolidation after liquefaction or lateral cap movement. However, deformed or damaged caps could be easily repaired after the event.
 - **Deformation of Slip 1 Side Slope.** A small area of surficial PCB contamination (based on a single analytical result from 2004) is located on a relatively steep slope (approximately 2:1) on the southwest side of Slip 1. Further assessment would be
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needed to determine if additional slope stabilization measures (e.g., armoring, toe buttress) would help reduce the risk of slope failure in this localized area.

3.3 Wind and Vessel Waves

Erosive forces from waves are concentrated in shallow water depths (i.e., less than 15 feet; LWG Draft FS Appendix Hc; EPA FS Figure 3.4-17). Most of the contamination at T4 resides on the waterway floors, which are virtually unaffected by these forces. Most terminal side slopes are riprapped to prevent erosion and sloughing. Side slopes in Slip 3 are further reinforced with a sheetpile wall and a timber pinch pile bulkhead.

This Wheeler Bay shoreline has some of the highest exposure to waves and river traffic of any areas at T4. However, the Wheeler Bay shoreline was stabilized during the 2008 Early Action using a combination of habitat elements (e.g., native riparian plantings, large woody debris, and habitat substrate) and more localized structural elements (e.g., riprap). The Wheeler Bay shoreline is routinely monitored for evidence of wave erosion, and in one instance following a high-water event in June 2011, the need for a shoreline repair was identified and implemented (Anchor QEA 2012).

3.4 Vessel Propwash

Short-lived propwash events may briefly resuspend sediments during vessel docking at Berths 410 and 411. However, any temporarily resuspended sediments are expected to resettle quickly and be retained within the slip due to the short duration of the events and the quiescent nature of this off-channel waterway (see Section 1).

Propwash scour depths of a few feet are possible in the vessel approach lane at Slip 3 (LWG Draft FS Appendix Fb, Table 3). Propwash effects in Slip 1 and Wheeler Bay are negligible due to a lack of vessel activity, now or in the future. For brief periods (i.e., typically averaging about 1 hour), increased bottom velocities may be experienced during vessel docking. Tugs exert their maximum horsepower (usually no more than 1/3 power) only for short bursts (i.e., 0.5 to 2 minutes) during critical vessel maneuvers (Port of Portland 2016; Anchor Environmental et al. 2006, Appendix L). In addition, the operational practice at Slip 3 is to turn large vessels sideways in the river and berth them stern first; thus, if the ships

engage their power when they exit the berth, propwash forces will be directed toward the back of the slip.

Any remedial actions that are planned to be implemented in the Slip 3 berthing areas or vessel approach lane will need to consider appropriate protections from propwash forces. The remaining parts of T4 are net depositional and largely removed from the effects of propwash.

3.5 In-Water Construction

The Port has successfully completed numerous in-water construction projects at T4 without incidence of water quality impacts (Anchor QEA et al. 2009; Port of Portland 2015). Water quality monitoring data and modeling results using the U.S. Army Corps of Engineers (USACE) DREDGE model indicate suspended sediments generated during dredging are retained within the construction zone near the dredge. In addition, regulatory programs are in place to ensure that appropriate environmental controls and best management practices are employed for all construction projects.

3.5.1 *Track Record of Successful Projects*

The Port already has a proven track record of successful dredging and construction projects at T4 in compliance with environmental permitting and monitoring requirements, including ongoing work needed to maintain the integrity and safety of terminal structures and operations. The 2008 Early Action, maintenance dredging actions in 2008 and 2013, and various fender pile replacement projects have all been performed at T4 without any significant turbidity or water quality impacts.

3.5.2 *Control of Suspended Sediments during Dredging*

The DREDGE model (Kuo and Hayes 1991) supported by the USACE was used to predict suspended sediment releases during remedial dredging for the 2008 Early Action (Anchor Environmental et al. 2008). DREDGE model results showed that suspended sediment concentrations were reduced to ambient river levels within approximately 80 feet from the dredge. The contamination in the head of Slip 3 is approximately 500 feet inland from the mouth of the slip, so any contaminants that might be resuspended by dredging or other

construction activities would be expected to be well contained within the slip. These model predictions were confirmed during Early Action water quality monitoring (see Section 4.1.3).

3.5.3 Regulatory Oversight Is in Place

EPA does not need to trust that the Port will do the right thing during construction. Regulatory programs are in place to control in-water construction activities and to ensure adequate environmental protections are employed. All proposed in-water permitting projects within and upstream of the Portland Harbor, including the Downtown Reach of the Willamette River, are reviewed by the Portland Harbor Interagency Permit Coordination Team, which consists of the EPA, USACE, Oregon Department of Environmental Quality (DEQ), Oregon Department of State Lands (DSL), and National Oceanic and Atmospheric Administration (NOAA). All dredging projects in the Portland District of the USACE are reviewed by the Portland Sediment Evaluation Team (PSET) in accordance with the Sediment Evaluation Framework for the Pacific Northwest (USACE et al. 2016). PSET member agencies similarly include the USACE, EPA, DEQ, DSL, NOAA, as well as others.

4 TERMINAL 4 SEDIMENTS ARE CHEMICALLY STABLE

In addition to being physically stable, T4 contaminants are strongly bound to sediments and are not easily solubilized into more bioavailable and toxic aqueous forms as evidenced by bioassay tests, dredging elutriate tests (DRETs), and water quality monitoring data. Recent sediment characterization data collected for navigational dredging at Berth 410 indicate that any residual contaminants that may still be present in Slip 3 are retained in the slip and are not being dispersed into the mainstem river.

4.1 Lack of Contaminant Mobility

Much of the polycyclic aromatic hydrocarbon (PAH) contamination in Slip 3 is derived from historical pencil pitch releases. Pencil pitch PAHs are strongly bound to the sediment phase, and when those sediments are suspended in the water column, they have limited mobility and greatly reduced toxicity compared to other more common forms of PAHs, such as fuel leaks, spills, and road runoff, as supported by the lines of evidence presented in this section.

4.1.1 Bioassay Tests

Bioassay tests conducted on sediments in Slip 3 and Wheeler Bay (Hart Crowser 2000) showed that the PAHs in these sediments have limited bioavailability and toxicity. Sediment samples with total PAH concentrations ranging from 129,000 to 513,000 micrograms per kilogram passed a suite of three acute and chronic bioassay tests. Although some samples within that concentration range failed bioassay tests, those failures were mostly attributed to more bioavailable diesel fractions associated with former petroleum seeps at the head of the slip that have since been remediated.

4.1.2 Dredging Elutriate Tests

DRETs provide laboratory simulations of contaminant releases from T4 sediments associated with the Early Action dredge prism (Anchor Environmental et al. 2008). DRETs showed that water quality effects associated with Early Action dredging areas, which by design included some of the most contaminated sediments at T4, were expected to be negligible. Only a few PAHs were detected in the elutriate water, and the infrequent detections were at least 100 times lower than EPA-approved construction water quality criteria.

4.1.3 Water Quality Monitoring Data

Water quality monitoring during the 2008 Early Action (Anchor QEA et al. 2009) showed that sediments and contaminants were well controlled during the 6-week construction period (August 12 to October 1, 2008). There were no exceedances of water quality field parameters (including turbidity) at the compliance boundary during dredging or capping operations in Slip 3, and no exceedances of water quality analytical parameters (PAHs, cadmium, lead, and zinc). PAHs were rarely detected, and if detected, they were usually at least ten times lower than their construction water quality criteria, consistent with DRET results (see Section 4.1.2).

4.2 No Evidence of Contaminant Migration from Slip 3

Berth 410 is on the outer, downstream corner of Slip 3. This is a known depositional area requiring periodic maintenance dredging. The enhanced sedimentation in this berth is likely

caused by the clockwise eddy in the outer part of Slip 3 that induces suspended sediments in the Willamette River to spin off the mainstem current and settle out in the slip.

Any PAHs that might be resuspended in Slip 3, by whatever mechanism, would have to pass through or near Berth 410 to join the mainstem river, and a portion of those resuspended sediments would get trapped in the eddy circulation and settle out in Berth 410, providing a record of contaminant dispersion if it was occurring. However, sediments in the outer two-thirds of Berth 410 were recently shown to be suitable for unconfined in-water disposal (PSET 2012). Thus, relatively clean sediments are being deposited in the mouth of Slip 3, providing evidence that contaminated sediments remaining in the interior of Slip 3 are not being mobilized out of the slip and into the mainstem river.

5 SEDIMENT STABILITY CAN BE ENHANCED WITH ENGINEERING CONTROLS

To the extent that additional remediation is needed at T4, sediment caps (with or without reactive amendments), in situ treatment, EMNR, and/or MNR can be designed to provide effective and long-term control of contaminated sediments. These technologies can be designed to resist or accommodate physical mixing processes (e.g., propwash) using accepted industry practices, design, and construction methods.

An armored cap containing organoclay has already been successfully installed on 3:1 to 4:1 slope at the head of Slip 3 as part of the Early Action (Anchor QEA et al. 2009). The treatment cap controls underlying diesel seepage and the armor layer is resistant to propwash forces from Berth 411. The cap has been monitored since construction and found to be performing as designed (Anchor QEA 2016; Apex 2016).

In consideration of the various lines of evidence for sediment stability at T4, in-place remedial technologies were not given their due consideration during EPA's alternatives analysis. LWG Draft FS Appendix Hc provides extensive technical analyses to support the physical and chemical integrity of cap designs in Portland Harbor, including T4. Cap armor layers and chemical isolation layers can be reasonably designed to withstand known or expected erosive forces (e.g., currents, propwash, and wave action) and anticipated contaminant flux rates.

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APPENDIX B2
OPERATIONS AND SECURITY AT PORT
OF PORTLAND'S TERMINAL 4



PORT OF PORTLAND

Box 3529, Portland, Oregon 97208
(503) 944-7000

MEMORANDUM

Date: September 6, 2016
To: Environmental Protection Agency, Region 10
From: Jeff Krug, Director, Port of Portland Marine Operations
Re: Operations and Security at Port of Portland's Terminal 4

Port of Portland Marine Operations provides these facts in response to the Environmental Protection Agency's assumptions for exposure to contaminated sediments at the Port of Portland's (the "Port's") Terminal 4 facility. The assumed exposure is an individual fishing from a boat 260 days per year for 70 years, covering hands and forearms and ingesting sediment each time. This assumption is not realistic in the relevant areas of Terminal 4 due to public access restrictions for terminal commercial activity and facility security requirements.

1. Terminal 4 Introduction

Terminal 4 is a secured marine facility located on the Willamette River at river mile 4.5. It is one of four marine terminals that the Port owns and leases for marine business operations, consistent with Port's mission under state law. The Port acquired Terminal 4 in 1971 from the City Commission of Public Docks, which had owned it since 1917.

The Port provides institutional management and leases operational areas within Terminal 4 to long-term tenants. The Port is responsible for maintaining a dedicated security operation consistent with the Port's Facility Security Plan. There is no public access to the facility and no way for the public to access the shoreline by land.

Terminal 4 has two deepwater, off-channel slips, as well as an auto facility berth and a liquid bulk berth. Slip 1 is inactive. Berths 410/411 in Slip 3 is the most active ship berth in the Portland Harbor. Wheeler Bay is an embayment on the opposite side of the Berth 410 pier from Slip 3.

2. Long-Term Bulk Cargo Operations at Berths 410/411

Since 1987, the Port has leased Berths 410/411 for export of soda ash to Kinder Morgan.¹ Soda ash, also known as trona, is used in the manufacture of glass and detergents, and it is exported through Portland to countries around the world.

¹ In 1998, Hall Buck Marine, Inc. (the original 1987 lessor) changed its name to Kinder Morgan Bulk Terminals, Inc., which, in 2004, assigned its rights and obligations under the lease to Kinder Morgan.

The bulk soda ash handled through the Kinder Morgan facility is mined and milled in Wyoming, arrives at Terminal 4 in rail car unit trains, and is exported to Pacific Rim and South American markets. While soda ash is also shipped through ports in Texas, Washington, and California, Portland ranks as the largest export gateway for soda ash in the United States (50 percent of volume), with over 2.6 million metric tons a year passing through Terminal 4.²

The Port's current 2012 lease to Kinder Morgan is effective to December 2022, with Kinder Morgan retaining two, five-year options to extend until December 2032.³ Kinder Morgan made a series of large capital investments at Terminal 4 between 2013 and 2015.⁴

On average for the five preceding years, a ship has been in Berths 410/411 for approximately 290 days a year, or roughly 80 percent of the days of the year.

Year	Count of vessel Calls	Average Duration	Approximate days occupied
2015	74	3.49	258
2014	77	3.71	286
2013	81	3.65	296
2012	103	3.07	316
2011	91	3.16	287
2010	107	2.79	298
AVERAGE:	89	3.31	290

3. Operation and Safety Considerations

Movement of extremely large ocean-going vessels in and out of Berths 410/411 creates navigational safety barriers to fishing in Slip 3. Vessels move in and out of Berths 410/411 approximately every two to three days. Each mooring or unmooring of a vessel in Berths 410/411 takes on average one hour. Using tugs, vessels are pivoted, backed in and held in place for placement of mooring lines. Water displacement during this operation creates dangerous conditions for fishing boats.

Once in Berth 410/411, it takes two to three days for vessels to be loaded with soda ash. The industrial activity associated with the loading operation make fishing in immediately adjacent areas within Slip 3 and Wheeler Bay unattractive.

Kinder Morgan, as a long-time tenant at Terminal 4, describes its experience with lack of public access to Terminal 4 in a letter enclosed as Attachment 1.

² Based on data from World Institute for Strategic Economic Research.

³ Port of Portland Commission Agenda, April 11, 2012, Item 3.

⁴ From 2012 to 2014, Kinder Morgan made a \$9.5 million capital investment in a new ship loader. See Port of Portland Commission Agenda, April 11, 2012, Item 3.

4. Security Regulations and Protocols

The Maritime Transportation Security Act (MTSA), enacted in 2002, requires the Port to adopt and implement a marine terminal security program for its marine terminals. The Port's Facility Security Plan (FSP), required by 33 C.F.R. 105 and approved by the USCG, is classified as sensitive security information and controlled under 49 C.F.R. parts 15 and 1520.

The Port's marine security officers maintain 24/7 patrol of Terminal 4 and have been instructed to follow a consistent security protocol since the Port implemented its comprehensive FSP in approximately 2006. The protocol is to direct unauthorized vessels to depart when they impact the Port's facility or when an authorized ocean-going vessel is arriving or departing, and to observe and request that unauthorized vessels depart at other times. The Port's security officers may seek assistance from the U.S. Coast Guard and local law enforcement to enforce the Port's security protocol, which is documented in a standard operating procedure. See Attachment 2 (Patrol Order Appendix G—Unauthorized Vessels Procedure).

In addition to the Port's implementation of its FSP to comply with MTSA requirements, there is a U.S. Coast Guard Restricted Navigation Area in Place to protect areas of engineered cap and bank stabilization that the Port constructed in its early removal action under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. 33 C.F.R. § 165.1326. Signs reading "NO ANCHORING, GROUNDING OR SHORE TIE-UPS" (8' x 4') are placed at the edge and center of Wheeler Bay, at the harbor line end of Berth 410, and at the head of Slip 3 to maintain this restriction.

5. Port Employee Observations of Fishing Activity

Over the past decade, key Port employees with responsibility for security and operations at Terminal 4 have observed less than 10 isolated fishing incidents in the areas adjacent to Berths 410/411—i.e., in Slip 3 or Wheeler Bay—amounting to approximately one occurrence a year. Less than six fishing boats per year have been observed entering the inactive Slip 1. Vessels that enter do not anchor and have complied with security officers' requests to depart.

The very active bulk mineral export operations, associated navigational safety considerations, and security regulations and protocols effectively deter fishing in Slip 3 and Wheeler Bay. With an 80 percent average vessel occupancy rate in Slip 3, and the Port's existing security protocols, the assumption that fishing frequently occurs at Terminal 4 is not accurate.

APPENDIX B2 - ATTACHMENT 1

KINDER MORGAN
TERMINALS
West Coast Region

September 6, 2016

Attn: Harbor Comments
U.S. EPA, 805 SW Broadway, Suite 500
Portland, OR 97205

RE: Kinder Morgan Ship Loading Operations at Terminal 4

Dear Sir or Madam:

Kinder Morgan Bulk Terminals, Inc. (Kinder Morgan) is providing the following information in support of both the Port of Portland's and Kinder Morgan's comments on the United States Environmental Protection Agency's (U.S. EPA's) June 8, 2016 Proposed Plan for the Portland Harbor Superfund Site (Proposed Plan). In this letter, Kinder Morgan describes its ship loading operations at its Terminal 4 facility and the lack of public access to the slip and shore areas of the facility.

Kinder Morgan Operations at Terminal 4, Slip 3

Kinder Morgan's Terminal 4, Slip 3 facility spans approximately eight acres of heavy industrial land on the eastern shore of the Willamette River, directly to the south of Slip 1 and directly north of the Toyota facility at river mile 4.5. The Kinder Morgan facility is leased from the Port of Portland and consists of a loading dock (berths 410/411), a ship loader, rail lines, an office building and a warehouse.

Terminal 4 has been an active industrial site for more than 100 years and will remain one into the foreseeable future. At Slip 3, berths 410/411, Kinder Morgan unloads bulk soda ash from rail cars and loads it onto ships for export. The ships are extremely large—approximately 200 meters long with a capacity to carry up to 50,000 tons of cargo—and fill most of the slip when at the berth. Ships are loaded 5 days per week, year-round, and include both day and night shifts. In 2015, Kinder Morgan loaded 2.6 million metric tons of soda ash onto 75 ships over a period of 229 day shifts and 169 night shifts. Kinder Morgan estimates that it will load 3 million metric tons of soda ash in 2017. At this pace, ships move in and out of the slip every 2-3 days.

Kinder Morgan has operated at Terminal 4 for nearly 20 years. Between 2013 and 2015, Kinder Morgan made significant upgrades to the facility to maximize efficiency and environmental protection. Kinder Morgan removed the old ship loader and constructed a new, state of the art ship loader and dust control system. Kinder Morgan's current lease term extends through December 2022, and the company has no plans to stop operating at the facility. Given its

location and improvements, there is no other productive use for the property other than heavy industrial operations.

Public Access is Prohibited

Access to the facility is strictly controlled. The only access point to the Terminal via land is through the secured main entrance. The public is not allowed within the terminal or berth property without prior approval from Kinder Morgan management. Further, Kinder Morgan is required to report any trespass to the Port. When loading ships at the berth, other vessels (including fishing boats) are discouraged from entering the slip for safety reasons, and, there is a U.S. Coast Guard Restricted Navigation Area in place to protect areas of engineered cap and bank stabilization in Slip 3 and Wheeler Bay. Multiple signs reading "NO ANCHORING, GROUNDING OR SHORE TIE-UPS" are located at the edge and center of Wheeler Bay, and at the entrance and head of Slip 3, to maintain this restriction.

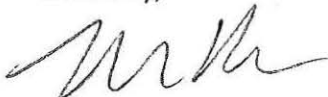
No Recreational Use

Even if the facility were open to the public, the shoreline in and around Terminal 4, Slip 3 has virtually no beach or shallow water areas for the public to access. The slip is bordered on the north side by a 330 meter long, 10 meter high loading dock. The shoreline at the head of the slip consists of a 100 meter long, steep, vegetated riverbank with approximately 2-3 meters of rocky beach at the foot of the bank. This shoreline is almost completely obstructed by a line of wooden pilings capped with a metal rail. The southern edge of the slip consists of a 6 meter high concrete and wood retaining wall bordered by dozens of decaying wood pilings that historically supported a loading dock. The riverbed within Slip 3 drops steeply from the shoreline, reaching a maximum depth of 12.2 meters in the center of the slip. As a result, there is no beach use, clamming, shore fishing or other recreational activity that occurs in and around the Kinder Morgan facility. Although fishing boats have the ability to access Slip 3 from the main channel of the river, they are rarely spotted in or near the slip due to the heavy industrial activity and shipping traffic.

Conclusion

Given the industrial nature of Kinder Morgan's operations and the limited opportunities for public access to the shoreline and near-shore sediments, the U.S. EPA's assumptions regarding recreational beach user, diver and fisher exposure to contaminated sediments at Terminal 4 are unrealistic and should be revised to more accurately reflect site-specific uses.

Sincerely,



Mark Price
Director of Operations

APPENDIX B2 - ATTACHMENT 2



PATROL ORDERS APPENDIX – G
Unauthorized Vessels Procedure

Background – Presence of unauthorized vessel(s) in an active marine slip(s) may present security and operational hazards. Maintaining safety for vessel movement and facility security require consistent protocol for addressing vessels not authorized to call at terminal berths (unauthorized vessel(s)) and to support vessel(s) authorized to call.

Action – Marine Security Officers shall follow these procedures for addressing unauthorized vessel(s).

Unauthorized vessels – restricted and secure areas

1. During patrol, observe slips for unauthorized vessel(s) present under or tied off to facility infrastructure.
2. If unauthorized vessel(s) are present under or tied off to facility infrastructure, verbally direct vessels to vacate the facility.
3. If unauthorized vessel(s) do not promptly respond to verbal direction, call the duty Facility Security Officer to contact local law enforcement and/or U.S. Coast Guard to request they take appropriate enforcement action.
4. Document incident in "Daily Shift Report" (DSR).

Unauthorized vessels – vessel arrivals and departures

1. Prior to scheduled vessel arrivals and departures, observe slip for unauthorized vessel(s).
2. If unauthorized vessel(s) are present prior to or during vessel arrivals or departures, verbally direct vessel(s) to vacate the slip to accommodate vessel and River Pilot movement in/out of berths.
3. If unauthorized vessel(s) do not promptly respond to verbal direction, call the duty Facility Security Officer to contact local law enforcement and/or U.S. Coast Guard to request they take appropriate enforcement action.
4. Document incident in DSR.

Unauthorized vessels – other

1. During patrol, observe slips for unauthorized vessel(s) and note behavior of such vessels.



PORT OF PORTLAND

PATROL ORDERS APPENDIX – G
Unauthorized Vessels Procedure

Date: 6/27/2016

Revision: 1

Owner: Marine Security

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2. If unauthorized vessel(s) remain in a slip for an extended period, verbally request that the vessel(s) move on.
3. If observation identifies safety or security concerns with any unauthorized vessel(s), call the Duty Facility Security Officer to contact local law enforcement and/or U.S. Coast Guard.
4. Document incident in DSR.

APPENDIX C

Appendix C – Legal Memorandum

Summary of CERCLA Process and Key Deficiencies in EPA's Approach

The Port of Portland ("Port") wants a cleanup of the Portland Harbor Superfund Site ("Site") that is protective of human health and the environment and that is cost-effective—two legally required components of any site cleanup. The Port's proposal to modify the alternative identified in the Environmental Protection Agency's (EPA's) Proposed Plan would enable equally protective, less costly remedies to move forward at two discrete and unique areas within Portland Harbor—Swan Island Lagoon¹ and Terminal 4²—and maintain remedy flexibility for similar approaches in other areas of the Site. If EPA's alternative is not modified, then a timely cleanup of the Site will be jeopardized, and focus will likely shift to major legal and technical deficiencies in EPA's approach. These major deficiencies are described in this Appendix.³

The Comprehensive Environmental Response, Compensation and Liability Act at 42 U.S.C. § 9601 *et seq.* (CERCLA or "Superfund") and its implementing regulations in the National Oil and Hazardous Substances Pollution Contingency Plan at 40 C.F.R. § 300 *et seq.* ("NCP") detail the process to accomplish a Superfund site study (known as a remedial investigation and feasibility study (RI/FS)) and issue a cleanup decision (accomplished by way of a Proposed Plan and Record of Decision (ROD)).

Site studies and cleanup selections are technical and complex endeavors. However, EPA is bound to comply with the defined provisions of CERCLA and the NCP to achieve site cleanup. EPA has also issued numerous guidance documents applicable to site studies and cleanup that ensure the agency makes scientifically sound and nationally consistent remedy decisions.

EPA's determinations about how to clean up a site are reviewable. On review, courts do not simply rubber stamp EPA's decisions. Instead, courts carefully review the ROD to ensure that decisions are based on an appropriate evaluation of relevant factors. A court will set aside EPA's remedy selection decision if the administrative record shows that the decision is arbitrary and capricious or otherwise not in accordance with law. An agency decision is arbitrary and capricious if it:

- relied on factors which Congress has not intended it to consider;
- entirely failed to consider an important aspect of the problem;
- offered an explanation for its decision that runs counter to the evidence before the agency; or

¹ Referred to herein as "Swan Island Lagoon," "Swan Island," or the "Lagoon."

² The Port has focused on Swan Island and Terminal 4 for different reasons. The Port owns Terminal 4 and has been deeply involved in leading cleanup there. The significant in-water cleanup and upland source control work already accomplished by the Port are detailed in Appendix B. Swan Island, by contrast, is a large area with a complex history of ownership and operations, making allocation of potential liability uncertain and shared among many parties. Because of Swan Island's unique qualities within Portland Harbor, the Port has focused on solutions there and has worked with a coalition of potentially responsible parties to develop the equally protective, cost-effective, and implementable remedy approach detailed in Appendix A.

³ This Appendix covers some issues of particular importance to the Port that are also addressed in the comments of the Lower Willamette Group (LWG), of which the Port is a participating member. This Appendix refers to and cites sections of the LWG's comments also filed on September 6, 2016 ("LWG Comments").

- is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.

Here, EPA's approach to develop and select a remedy at the Site is fundamentally deficient, as well as arbitrary and capricious. Deficiencies in EPA's proposal include that it:

- selects a remedial goal that is so low that it cannot be met because low-level upstream and upland background sources will recontaminate any cleanup, and EPA has ignored site specific data that demonstrates this inevitable outcome;
- rejects the 2015 Draft FS's⁴ approach to calculating risk reduction from Enhanced Natural Recovery (ENR) without any reason and ignores the material impact that ENR would have on reducing risk in Swan Island Lagoon;
- uses Principal Threat Waste (PTW) as a basis for a more expansive remedy at higher costs, which is inconsistent with law, technically unsupported, does not increase overall protectiveness of the remedy, and stands apart from EPA's treatment of PTW at any other Superfund sediment sites;
- assumes without data or rationale that fishers and divers are frequently present at Terminal 4—an active marine terminal—and cover large portions of their bodies with sediment;
- rejects multiple lines of evidence regarding impacts and risk to benthic organisms, in favor of unsupported use of individual benthic sediment quality values and ignoring empirical data; and
- fails to adequately develop, consider, and balance the remedy selection criteria as required by the NCP.

EPA must correct these deficiencies or provide for flexibility in the ROD to allow site-specific conditions and updated data to inform remedy selection, design, and action, and amend—as appropriate—remedial goals. Flexibility needed on a Site-wide and site-specific basis is described in Section III of this Appendix. Using this flexible approach at Swan Island Lagoon and Terminal 4 (as described in Appendix A and Appendix B, respectively), the ROD should be adjusted to address the following:

- Swan Island Lagoon
 - Allow for inclusion and consideration of key site-specific conditions, such as:
 - up-to-date future maintenance dredge (FMD) designations and required navigational depths;
 - current bathymetry data in comparison to required navigation depths;
 - evidence of sediment stability in the Lagoon;
 - up-to-date surface sediment polychlorinated biphenyls (PCB) concentration data;
 - effective in-place containment or treatment of PTW; and
 - practical source control measures.

⁴ U.S. Env'tl. Prot. Agency, *Portland Harbor Feasibility Study Report* (2015) ("2015 Draft FS").

- Add a single unified technology assignment flowchart and revised multi-criteria decision matrix for the Swan Island sediment decision unit (SDU), as described in Appendix A.
- Maintain flexibility in the remedial design process so that a series of site-specific investigations can further inform and better manage key assumptions and uncertainties identified by EPA.
- Terminal 4
 - Make a site-specific risk management decision that human health direct contact exposure scenarios are inapplicable at Terminal 4 because of public access restrictions;
 - Allow benthic risk areas to be identified by technically supportable benthic risk analysis confirmed by site-specific toxicity testing; and
 - Improve flexibility in technology assignment flowcharts.

These adjustments are consistent not only with CERCLA and the NCP, as they will result in a cost-effective remedy for these areas of the Site that is protective of human health and the environment, but also with EPA national guidance, which promotes gathering and learning from site-specific data in the course of remedy selection, design, and cleanup at sediment sites. Without such adjustments, EPA's preferred alternative is legally vulnerable, unimplementable, and will result in inevitable delay in reaching a cleanup solution.

This Appendix is organized as follows:

- Section I provides an overview of the RI/FS and remedy selection process required under CERCLA, the NCP, and EPA guidance;
- Section II describes the standard of review of EPA's remedy selection decision and discusses key legal and technical deficiencies in EPA's Proposed Plan for the Site that are arbitrary and capricious or otherwise not in accordance with law; and
- Section III summarizes EPA's national guidance on how to move forward at sediment sites and discusses how the Port's proposed adjustments to EPA's approach are necessary and consistent with that guidance.

I. Overview of RI/FS and Remedy Selection Process

a. Overview of the RI/FS information-gathering process to provide a foundation for a site-specific and supportable remedial action

The RI/FS process begins when a contaminated site is preliminarily identified by EPA and placed on the National Priorities List (NPL). The NPL is a list required by CERCLA representing national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and intended to guide EPA in determining which sites warrant further investigation.⁵

⁵ See, e.g., Environmental Protection Agency National Priorities List Proposed Rule, 80 Fed. Reg. 58,658 (proposed Sept. 30, 2015) (to be codified at 40 C.F.R. pt. 300).

After a site is placed on the NPL, the first key step in the Superfund process is the performance of a RI/FS.⁶ Generally speaking, the RI/FS gathers information to evaluate risk and remedial options to reduce that risk at a given site.⁷

The RI (1) determines the nature and extent of contamination at the site or operable unit, including the source, potential routes of migration, and current and potential human and environmental receptors; (2) assesses risks to human health and the environment from contamination; and (3) summarizes results from treatability tests to evaluate the potential effectiveness and cost of potential treatment technologies to reduce risks.⁸

The project scoping stage of the RI and baseline risk assessment is critical to the success of a Superfund project. The risk assessment should be conducted in accordance with all appropriate guidance and policies, including EPA's 11 risk management principles ("Risk Management Principles").⁹ The transparent application of the Risk Management Principles helps prevent the overstatement of risks, which could force a remedy selection that would not reduce risk and thus would be inappropriate.¹⁰

Under these Risk Management Principles, EPA must evaluate the assumptions and uncertainties associated with site characterization data and site models; select site-specific, project-specific, and sediment-specific risk management approaches that will achieve risk-based goals; and ensure that sediment cleanup levels are clearly tied to risk management goals.¹¹

The purpose of the baseline risk assessment is to estimate the risks a site poses now and would pose in the future if no cleanup action were taken.¹² The baseline risk assessment provides the basis for taking action and identifies contaminants and the exposure pathways that need to be addressed by the remedial action.¹³ These baseline risk assessments are designed to be conservative and to protect sensitive populations, but they must nevertheless be founded on reasonable and realistic exposure assumptions.

Information from the baseline risk assessment informs the Proposed Plan; as such, the assessment requires site-specific data on major chemicals of concern in each medium; potentially exposed populations in current and future risk scenarios; exposure pathways

⁶ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, EPA 540-R-98-031, *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* at 1-2 (1999) ("Preparing Proposed Plan Guidance").

⁷ *Id.* at 1-2.

⁸ *Id.*

⁹ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, OSWER Dir. 9285.6-08, *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites* at 1 (Feb. 2002).

¹⁰ Nat'l Research Council, *A Risk-Management Strategy for PCB-Contaminated Sediments* 171 (2001).

¹¹ See Office of Emergency and Remedial Response, U.S. Env'tl. Prot. Agency, EPA 9285.7-47, *Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual, Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments* 3.1.2 (Dec. 2001) ("Uncertainty assessment is important in risk assessment. Although the risk assessment should indicate sources of variability and uncertainty throughout the process, it will generally be appropriate to include a separate section of the Baseline Risk Assessment Report that also focuses on the uncertainties associated with data evaluation, toxicity assessment, exposure assessment, and risk characterization, as well as overall uncertainty of the final risk numbers.").

¹² *Preparing Proposed Plan Guidance*, at 1-5.

¹³ *Id.* at 1-5.

affecting each population group, assuming reasonably anticipated future land and water uses; and human health and ecological risk characterizations.¹⁴

The FS develops and evaluates potential remedial alternatives to reduce risks defined in the RI.¹⁵ The alternatives are developed based on how EPA defines remedial action objectives (RAOs), general response actions, volumes or area of contaminated materials to be remediated, and the range of potential treatment technologies.¹⁶

Following a preliminary screening of alternatives, a reasonable number of appropriate alternatives undergo a detailed analysis in the FS using the nine NCP evaluation criteria.¹⁷ The NCP evaluation criteria are used to compare remedial alternatives, to establish a basis remedy selection, and to satisfy statutory requirements.¹⁸

The two threshold criteria are statutory requirements that must be satisfied by any alternative to be eligible for selection: (1) overall protection of human health and the environment; and (2) compliance with applicable or relevant and appropriate requirements (ARARs).¹⁹ ARARs include any federal or state standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate to a CERCLA site or action.²⁰ The remedial action(s) presented in a Proposed Plan must attain or waive federal environmental ARARs or more stringent state environmental ARARs.²¹ ARARs are identified on a site-by-site basis.

Five primary balancing criteria are used to identify major trade-offs between remedial alternatives, which are ultimately balanced to identify the preferred alternative and to select the final remedy: (1) long-term effectiveness and permanence; (2) reduction of toxicity, mobility, or volume; (3) short-term effectiveness; (4) implementability; and (5) cost.²² Finally, the two modifying criteria, which may not be considered fully until after the formal public comment period on the Proposed Plan is complete, include: (1) state acceptance; and (2) community acceptance.²³

After each alternative is evaluated against the NCP criteria, they are then compared against each other to gauge their relative effectiveness to reduce risk.²⁴ Each alternative that makes it to this stage of the analysis, with the exception of the required "No Action" alternative, is expected to be protective of human health and the environment and comply with any ARARs (unless a waiver is justified).²⁵

¹⁴ *Id.* at 3-3, 3-15.

¹⁵ *Id.* at 1-5.

¹⁶ *Id.* at 1-5.

¹⁷ *Id.* at 1-5; *see also* 40 C.F.R. § 300.430(e)(9).

¹⁸ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, OSWER 9355.0-27FS, *A Guide to Selecting Superfund Remedial Actions* at 1-2 (April 1990) ("Selecting Remedy Guidance"); 40 C.F.R. § 300.430(f)(1).

¹⁹ *Selecting Remedy Guidance*, at 3.

²⁰ *Preparing Proposed Plan Guidance*, at 1-5. One example of an ARAR is that source control remedies at industrial facilities which involve placement of Resource Conservation and Recovery Act (RCRA) hazardous waste should discuss RCRA Land Disposal Restrictions. *Id.* at 3-6.

²¹ 42 U.S.C. § 9621(d).

²² *Selecting Remedy Guidance*, at 3.

²³ *Id.* at 3.

²⁴ *Preparing Proposed Plan Guidance*, at 1-5.

²⁵ *Id.* at 1-5.

CERCLA, the NCP and EPA Guidance require that remedies be cost effective. Cost estimates “should clearly present” the “expected accuracy range of the cost estimate.”²⁶ The expected accuracy range of cost estimates generated during the “detailed analysis of alternatives” phase is -30 to +50%.²⁷ Cost-effectiveness is determined by evaluating long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short-term effectiveness to determine overall effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective. A remedy is cost effective if its costs are proportional to its overall effectiveness.²⁸

b. Cleanup goals developed in the RI/FS must be achievable, site-specific, and account for background conditions

The successful implementation of remedial action at the Site is contingent upon selecting cleanup levels that are achievable via a sediment remedy. The FS formulation of viable alternatives involves defining RAOs, which are media-specific cleanup goals for a selected remedial action, to be incorporated later into a major section of the Proposed Plan.²⁹ Preliminary remediation goals (PRGs) are the initial or proposed cleanup goals to achieve RAOs. Remedial Action Levels (RALs) generated during the FS are defined as the maximum concentration that may be left in place at any location within an exposure unit such that the average concentration will not present a risk above levels of concern; are considered a “not-to-exceed” threshold or action level for purposes of site remediation; and are used to define the areas for active remediation and achieve the remediation goals.³⁰ PRGs are developed during the RI/FS to provide risk reduction targets, which are incorporated into the Proposed Plan and are eventually refined into remediation goals (RGs) or final cleanup targets in the final ROD.³¹

Remediation efforts are considered complete and no further action is necessary when RAOs or RGs are attained.³²

In developing RGs, the agency must consider a number of factors, including:

- Media of concern,
- Contaminants of concern (COCs),

²⁶ *Id.* at 1-1.

²⁷ *Id.* at 2-4. For example, “for an estimate of \$100,000, the actual cost of an alternative is expected to be between \$70,000 and \$150,000.” *Id.* at 2-6.

²⁸ Letter from Lower Willamette Grp. to Amy Legare, Chair, Nat’l Remedy Review Bd., U.S. Env’tl. Prot. Agency, “LWG Recommended Approach to Portland Harbor Cleanup Lower Willamette River, Portland Harbor Superfund Site” at 30 (Oct. 19, 2015) (“LWG NRRB Comments”); 42 U.S.C. § 9621(b)(1). The NCP preamble explains, “[i]n analyzing an individual alternative, the decision-maker should compare . . . the relative magnitude of cost to effectiveness of that alternative. In comparing alternatives to one another, the decision-maker should examine incremental cost differences in relation to incremental differences in effectiveness.” Furthermore, “if the difference in effectiveness is small but the difference in cost is very large, a proportional relationship between the alternatives does not exist,” and “[t]he more expensive remedy may not be cost-effective.” 55 Fed. Reg. 8728.

²⁹ Preparing Proposed Plan Guidance, at 1-5, 3-2.

³⁰ See Office of Emergency and Remedial Response, U.S. Env’tl. Prot. Agency, EPA 540-R-02-002, *Risk Assessment Guidance for Superfund: Volume III - Part A, Process for Conducting Probabilistic Risk Assessment* (Dec. 2001).

³¹ Office of Env’tl. Policy and Assistance, U.S. Dept. of Energy, DOE/EH-413/9711, *Development of Remediation Goals under CERCLA* at 2 (Aug. 1997).

³² *Id.* at 2.

- Future land use,
- Exposure pathways and receptors,
- Toxicity information, and
- Target risk factors.³³

The relevance of a RAO for a medium of concern must be evaluated.³⁴ For example, if a RAO targets shallow water in sand deposits that is not tapped for drinking purposes, then a PRG should not be based on primary drinking water standard because it is not relevant to actual use, and may be too stringent for a final RG.³⁵

PRGs must be based on exposure pathways and receptors that are site-specific, realistic, reasonable and complete.³⁶ "If PRGs are not based on site-specific exposure information (e.g., human activity patterns, recreational exposure factors, ecological exposure factors) they must be modified before they can become RGs."³⁷

RAOs may also vary widely for different parts of a Superfund site depending on exposure pathways.³⁸ For example, a sediment-cleanup site may include a recreational area used by fishermen and children, as well as a wetland that provides critical habitat for fish and wildlife. Both areas may contain similarly contaminated sediment; however, the different exposure pathways may result in different RAOs and RGs for each area to be protective of the different receptors (people and wildlife).³⁹

Contamination at a Superfund site may originate from on-site releases or from contamination that originated from other sources.⁴⁰ As such, cleanup goals must take background conditions into account. Background refers to constituents or locations that are not influenced by the releases from a site. It is usually described as naturally occurring—meaning substances present in the environment in forms that have not been influenced by human activity, or as anthropogenic—meaning natural and human-made substances present in the environment as a result of human activities (and not specifically related to the CERCLA release in question).⁴¹ In commercial and industrial settings, EPA guidance says it is "very important to include . . . ongoing sources in the evaluation of what sediment actions may or may not be appropriate and what RAOs are achievable for the site."⁴² EPA also says it is essential to "evaluate whether the RAO is achievable by remediation of the site or if it requires additional actions outside the

³³ *Id.* at 2.

³⁴ *Id.* at 2.

³⁵ *Id.* at 2.

³⁶ *Id.* at 2.

³⁷ *Id.* at 2-3.

³⁸ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, EPA 540-R-012, OSWER 9355.0-85, *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* at 2-15 (Dec. 2005) ("Sediment Guidance").

³⁹ *Id.* at 2-15.

⁴⁰ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, OSWER 9285.6-07P, *Role of Background in the CERCLA Cleanup Program*, at 3 (April 2002).

⁴¹ *Role of Background in the CERCLA Cleanup Program*, at 5.

⁴² *Sediment Guidance*, at 2-21.

control of [EPA],⁴³ and therefore, outside the scope of CERCLA. It is paramount that cleanup levels “reflect objectives that are achievable from the site cleanup.”⁴⁴

For risk management purposes, understanding whether background concentrations are high relative to the concentrations of released hazardous substances, pollutants, and contaminants help risk managers make decisions concerning appropriate remedial actions.⁴⁵ Cleanup levels are typically not set at concentrations below natural or anthropogenic background levels because background conditions would result in recontamination.⁴⁶ If a RAO is set below background concentrations, then the PRG for that chemical may be set at background concentrations.⁴⁷

Within the framework of EPA’s existing statutory and regulatory requirements, including the nine NCP remedy-selection criteria, EPA employs the Risk Management Principles to make scientifically sound and nationally consistent decisions at contaminated sediment sites.⁴⁸ These principles are intended to be carefully considered at contaminated sediment sites when planning and conducting site investigations, involving the affected parties, and selecting and implementing a response.⁴⁹

c. Following the RI/FS, EPA identifies its preferred alternative, presents its preferred alternative in a Proposed Plan for public comment, and issues a final determination on the remedy in a ROD

The Superfund program’s remedy selection process is the decision-making bridge between the analysis of remedial alternatives for cleaning up a site conducted in the RI/FS and the explanation of the selected remedy that is documented in a ROD.⁵⁰

CERCLA mandates that the selected remedy must: (1) protect human health and the environment; (2) comply with ARARs unless a waiver is justified; (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element, or provide an explanation in the ROD why the preference was not met.⁵¹

The national goal of the remedy selection process is “to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste.”⁵² In the NCP, EPA established a series of expectations for the agency to consider in developing remedial alternatives:

- Use treatment to address the principal threats posed by a site, wherever practicable.
- Use engineering controls, such as containment, for waste that poses a relatively low long-term threat or where treatment is impracticable.

⁴³ *Id.* at 2-15.

⁴⁴ *Id.*

⁴⁵ Sediment Guidance, at 2-6.

⁴⁶ *Id.* at 2-6.

⁴⁷ *Id.*

⁴⁸ *Id.* at 1-5.

⁴⁹ Risk Management Principles at 1.

⁵⁰ See Selecting Remedy Guidance, at 1.

⁵¹ 42 U.S.C. § 9621.

⁵² 40 C.F.R. § 300.430(a)(1)(i).

- Use a combination of methods, as appropriate, to achieve protection of human health and the environment.
- Use institutional controls, such as water use and deed restrictions, to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants or contaminants.
- Consider using innovative technology when such technology offers the potential for comparable or superior treatment performance or implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies.⁵³

The remedy selection process begins with the identification of a preferred alternative from among those evaluated in detail in the FS.⁵⁴ The preferred alternative is presented to the public in a Proposed Plan that is issued for comment along with the RI/FS.⁵⁵ Upon receipt of public comments on the Proposed Plan, EPA (in consultation with any supporting agencies) determines if the preferred alternative remains the most appropriate remedial action for the site or operable unit.⁵⁶ The final remedy is selected and documented in a ROD.⁵⁷

II. The Proposed Plan Is Arbitrary and Capricious and Not in Accordance with Law

a. Courts will overturn EPA's remedy selection if it is arbitrary and capricious or otherwise not in accordance with law

EPA actions under CERCLA are reviewable under the Administrative Procedure Act (APA) and Section 113(j)(2) of CERCLA.⁵⁸ The APA requires a reviewing court to "hold unlawful and set aside" an agency action that is found to be (1) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law; (2) unconstitutional; (3) contrary to law, such as beyond the agency's statutory authority; or (4) without observance of procedure required by law.⁵⁹ Courts "shall uphold [the EPA's] decision in selecting the response action unless the objecting party can demonstrate, on the administrative record, that the decision was arbitrary and capricious or otherwise not in accordance with law."⁶⁰

Under CERCLA or the APA, a court must examine "whether the decision was based on a consideration of the relevant factors and whether there has been a clear error of judgment."⁶¹ An agency decision is arbitrary and capricious if "the agency has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the

⁵³ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, EPA 540-R-97-013, OSWER 9355.0-69, *Rules of Thumb for Superfund Remedy Selection* at 2 (Aug. 1997); 40 C.F.R. § 300.430(a)(1)(iii)(AF).

⁵⁴ Selecting Remedy Guidance, at 2.

⁵⁵ *Id.* at 2-3.

⁵⁶ *Id.* at 3.

⁵⁷ Selecting Remedy Guidance, at 5.

⁵⁸ See 5 U.S.C. § 702, 704; 42 U.S.C. § 9613(j)(2).

⁵⁹ 5 U.S.C. § 706(2).

⁶⁰ 42 U.S.C. § 9613(j)(2); see also *United States v. W.R. Grace & Co.*, 429 F.3d 1224, 1232 (9th Cir. 2005) (reiterating the same).

⁶¹ *Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983) (quoting *Bowman Transp. Inc. v. Arkansas-Best Freight Sys.*, 419 U.S. 281, 285 (1974)).

agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.”⁶²

“Arbitrary and capricious are terms that describe the *manner* of remedy selection more than anything else. Arbitrary means the Government simply threw darts or flipped a coin, selecting the remedy without a basis in reason or science. Capricious means it rushed through the process or made a sudden, knee-jerk decision without hearing enough evidence.”⁶³

Judicial review is meaningless unless courts carefully review the record to “ensure that agency decisions are founded on a reasoned evaluation of the relevant factors” and avoid a “rubber-stamp” of administrative decisions that are deemed “inconsistent with a statutory mandate or that frustrate the congressional policy underlying a statute.”⁶⁴

In addition, while courts give deference to agency decision making, the degree of deference is not limitless. The following are a few examples where courts have found the arbitrary and capricious standard to be met under CERCLA:

- Agency's remedial action was inconsistent with the NCP. *Washington State Dept. of Transp. v. Washington Natural Gas Co., PacifiCorp* (“we have no difficulty concluding that [the agency's] actions were inconsistent with the NCP. [It] failed to assess accurately both the nature and the extent of the threat posed by the presence of PAHs in the soil, failed to evaluate alternatives in the matter prescribed in the NCP, and failed to provide opportunity for public comment. Given the high degree of inconsistency with the requirements set forth in the NCP, [the agency's] action is arbitrary and capricious.”).⁶⁵
- RI/FS did not meet standards required by the NCP. *Union Pacific R. Co. v. Reilly Industries, Inc.* (finding that “neither the Remedial Action Workplan nor the Remedial Action Implementation Report contain any discussion of the RI/FS criteria or provide a detailed analysis of remedial alternatives, the threat to public health or the environment, or the cost effectiveness of the thermal desorption remedy.”).⁶⁶
- There was no rational connection between the decision and the facts in the record. *U.S. v. W.R. Grace & Co.* (“EPA does not have free rein to ignore accepted scientific principle or to adopt findings that are wholly at odds with the record evidence[.] . . . Although deference to the EPA's interpretation is significant, it is not blind.”);⁶⁷ *In re Bell Petroleum Services, Inc.* (concluding that EPA's decision to provide an alternate water supply was arbitrary and capricious and a waste of money, where there was no evidence in the administrative record that anyone in the area was actually drinking chromium-contaminated water, and as such, the alternate water supply did not even reduce, much less eliminate, any public health threat).⁶⁸

⁶² *Id.* at 43; see also *Greater Yellowstone Coal. v. Lewis*, 628 F. 3d 1143, 1148 (9th Cir. 2010) (adopting and applying the *Motor Vehicle Mfrs. Ass'n* test for arbitrary and capricious agency conduct).

⁶³ *U.S. v. NCR Corp.*, No. 10-C-910, 2012 WL 3778950, at *4 (E.D. Wis. Aug. 30, 2012).

⁶⁴ *Ariz. Cattle Growers' Ass'n v. U.S. Fish and Wildlife*, 273 F.3d 1229, 1236 (9th Cir. 2001) (internal citations and quotations omitted).

⁶⁵ 59 F.3d 793, 806 (9th Cir. 1995).

⁶⁶ 981 F. Supp. 1229, 1238 (D. Minn. 1997), *reversed in part on state law claims*.

⁶⁷ 429 F.3d 1224, 1245 (9th Cir. 2005).

⁶⁸ 3 F.3d 889, 906 (5th Cir. 1993), *rev'd in part on other grounds*, 64 F.3d 202 (5th Cir. 1995), *rehearing denied* (Nov. 14, 1995).

- Lack of meaningful public comment. *Union Pacific R. Co. v. Reilly Industries, Inc.* (administrative record did not “support a determination that the remedial alternatives were a subject for any meaningful public debate.”).⁶⁹

b. EPA’s Proposed Plan is arbitrary and capricious due to errors in setting achievable cleanup goals and assessing risk

- i. EPA’s cleanup goal for PCBs based on an unreasonable background level is not achievable or sustainable

In Portland Harbor, EPA not only has failed to follow its own guidance but also has summarily dismissed the relevance of data showing that the remedial goal for the Site cannot be met because of the influence of background—specifically, upstream and upland areas, which historically and currently house commercial and industrial operations that contribute to PCB levels in the harbor.

EPA set the sediment remedial goal for PCBs at the Site at 9 ug/kg based on EPA’s calculation of background concentrations. However, substantial analysis and site-specific information provided to EPA show that PCB background levels are actually much higher than 9 ug/kg. As a result, recontamination from upstream and upland areas render the remedial goal simply unachievable.

Sediment background concentrations for Portland Harbor were the subject of a formal dispute between the LWG and EPA.⁷⁰ During that dispute, the LWG asserted that EPA excluded several samples from the upstream sediment dataset to derive a lower background concentration level for PCBs. The LWG also cited multiple lines of site-specific evidence demonstrating that the harbor-wide PCB background level should not be set below 20 ug/kg. EPA ignored this evidence and stood by the decision to exclude the samples, claiming that the excluded samples were outliers and represented contaminated conditions.

However, in the March 24, 2015 decision regarding dispute resolution, Richard Albright, the then-current Director of the Superfund program in Region 10, recognized the importance of off-Site sources of contamination:

I would like to emphasize that as noted by EPA’s Response at p. 24, there are sources of contamination outside of the Site—both upriver of the Site and within the downtown reach—that may affect the ability of cleanup efforts within the Site to equilibrate to the selected cleanup levels regardless of whether the cleanup level is based on risk, regulatory standard or background. In this regard, the Site is similar to other urban sediment sites which CERCLA addresses like the Lower Duwamish Site in Seattle.⁷¹

⁶⁹ 981 F. Supp. 1229.

⁷⁰ Request for Dispute Resolution of EPA’s Notice of Decisions on Background Regarding Section 7 of the Remedial Investigation; Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240.

⁷¹ Dispute Decision Regarding Lower Willamette Group Dispute dated Aug. 26, 2014, Portland Harbor Superfund Site, Administrative Order on Consent for Remedial Investigation/Feasibility Study, EPA Docket No. CERCLA-10-2001-0240 at 16 (U.S. Env’tl. Prot. Agency, Region 10, March 24, 2015).

The LWG did provide EPA with an evaluation of equilibrium concentrations for the Site.⁷² Specifically, the LWG recommended that the harbor-wide PCB equilibrium concentration was not likely to be lower than 20 ug/kg. Equilibrium is the only reliable indicator of future concentrations that can be achieved because it accounts for future bedding of contaminants through physical and chemical processes.⁷³ Yet, EPA ignored this information, too.⁷⁴ In issuing the FS and Proposed Plan, EPA did not include evidence from the LWG on equilibrium conditions; nor did EPA conduct its own equilibrium evaluation. EPA's conclusion, therefore, is not supported by the evidence and is not consistent with accepted scientific principles because the samples EPA ignored represent the condition of sediments upstream of the Portland Metro area. Moreover, EPA's decision on background is fundamentally flawed and results in the inability to reliably conclude that any of the remedial alternatives can effectively achieve long-term attainment of remedial goals.

In addition, the data that EPA used to support its background estimate did not contain samples from off-channel quiescent environments in developed areas, including Swan Island Lagoon and Terminal 4. Such areas are likely to have more fine-grained sediments (i.e., dominated by silt and clay) and higher organic carbon fractions that tend to bind more contaminants such as PCBs and, therefore, are likely to have higher bulk sediment COC concentrations when compared to areas with continuous water current.⁷⁵

With regard to Swan Island Lagoon, the urban/industrial environment that drains to Swan Island Lagoon and the Lagoon's hydrologically quiescent nature is likely to result in some recontamination of remediated surfaces, especially for ubiquitous chemicals such as PCBs. The level of contamination from such sources can be low, certainly lower than the RALs (the "not-to-exceed" threshold or action levels generated during the FS to define the areas for active remediation and achieve the remediation goals), but these off-Site sources are responsible for anthropogenic background levels. If concentrations from off-Site sources exceed background, then they will prevent achieving the background-based remedial goal. Indeed, data from storm water sampling in Swan Island Lagoon shows that PCB concentrations on fine materials range from 35 to 375 ug/kg. The source of PCBs in the storm water samples is unknown and may represent sources yet to be controlled or general anthropogenic background for urban/industrial settings. But what is certain is that this storm water source substantially exceeds EPA's 9 ug/kg remedial goal. At a minimum, additional data are needed in remedial design to determine achievable remedial goals.

Terminal 4 is similarly characterized by protected off-channel waterways. Although limited areas in the vicinity of the active berths may be reworked by propeller wash, fine-grained and organic-rich sediments are otherwise prevalent.⁷⁶ An accurate assessment of incoming material

⁷² "Sediment Equilibrium Estimates for the Revised Feasibility Study", an LWG Technical Memorandum submitted to EPA on August 7, 2014.

⁷³ Sediment Guidance, at 1-3.

⁷⁴ See *W.R. Grace & Co.*, 429 F.3d at 1245 ("EPA does not have free rein to ignore accepted scientific principle or to adopt findings that are wholly at odds with the record evidence[;]"); *Or. Natural Desert Ass'n v. Bureau of Land Mgmt.*, Civil No. 08-1271-KI, 2011 WL 5830435, at *20 (D. Or. Nov. 15, 2011) ("[A]ny failure of the [agency] to comply with its own agency guidance could be considered arbitrary and capricious.").

⁷⁵ See ITRC (Interstate Technology & Regulatory Council). 2014. Contaminated Sediments Remediation: Remedy Selection for Contaminated Sediments (CS-2), Section 2.2. Washington, D.C.: Interstate Technology & Regulatory Council, Contaminated Sediments Team.

http://www.itrcweb.org/contseds_remedy-selection.

⁷⁶ Appendix B-1.

should therefore consider site-specific characteristics and propensity to bind and concentrate contaminants that are ubiquitous in this urban environment.

In sum, EPA's decision on background is arbitrary and capricious because EPA ignored key data on both a harbor-wide and site-specific basis in determining background; its decision is inconsistent with accepted scientific approach and results in an implausible remedial goal that cannot and will not be achieved; and its decision results in an incomplete evaluation of the NCP balancing criteria since it cannot be reliably concluded that any of the remedial alternatives will achieve long-term effectiveness.

- ii. EPA ignores evidence that ENR would reduce risk and can play a larger role in an equally protective cleanup for Swan Island Lagoon

ENR refers to accelerating the natural recovery process by engineering means and may include the addition of a thin layer of clean sediment and/or additives (such as GAC) to enhance contaminant sorption or degradation.⁷⁷ ENR and GAC have been demonstrated to effectively reduce exposure and risk from PCBs and other bioaccumulative chemical contaminants. It is a commonly employed remedial alternative for contaminated sediment sites.⁷⁸

ENR is a significant element in all of the alternatives considered in the FS for Swan Island. EPA identified ENR as an applicable technology for Swan Island Lagoon, with ENR covering over 60% of the SDU for Alternative I. The FS concludes that ENR is expected to meet RAOs.⁷⁹ It provides that the thickness and composition of the ENR layer will be determined during remedial design,⁸⁰ but that a 12-inch layer is expected to be sufficient.⁸¹

Despite EPA's conclusions regarding the applicability and effectiveness of ENR in the Swan Island Lagoon environment, EPA has flatly ignored the impact of ENR on calculating levels of risk reduction, which is necessary to evaluating alternatives' effectiveness in reaching PRGs. That is, EPA's surface-area weighted average concentrations (SWAC) and risk calculations for the Swan Island Lagoon in the FS do not account for the benefits of ENR, including the use of GAC to further reduce contaminant mobility or toxicity.

EPA's failure to evaluate the benefit of ENR and GAC on risk reduction has a significant effect. It results in an incomplete analysis for each alternative in the FS and, therefore, prevents any meaningful comparison among the alternatives in accordance with the NCP. EPA's action is contrary to its own guidance that the benefits of ENR be considered in risk evaluations. EPA's Sediment Guidance directs the evaluation of effectiveness and permanence to include dredging, capping and MNR.⁸²

Significantly, EPA's actions are also contrary to the 2015 Draft FS,⁸³ which explicitly considered the benefits of ENR on the SWAC. In the 2016 FS, EPA failed to provide any rationale or basis for its change of decision to ignore the benefits and cost-effectiveness of ENR. This is exactly

⁷⁷ Sediment Guidance, at 4-11.

⁷⁸ See *id.*

⁷⁹ 2016 FS at 3-31.

⁸⁰ *Id.* at 3-32.

⁸¹ *Id.* at Appendix D, D-18.

⁸² Sediment Guidance, at ii.

⁸³ 2015 Draft FS, Table 4.2-4.

the type of action where courts have concluded that an agency has acted arbitrarily and capriciously.⁸⁴

As a result of EPA's shift on this critical issue regarding ENR, the LWG requested clarification in a list of questions submitted to EPA on July 10, 2016. EPA's response was as follows:

The post construction SWACs in the FS do not reflect the placement of ENR as they also do not include MNR. Both ENR and MNR are proposed to be used post-construction to achieve PRGs, thus, the SWACs are based only on the dredge and cap technology areas.

However, identification of ENR as a post-construction technology is inconsistent with EPA guidance, which provides that: "project managers may consider accelerating the recovery process by engineering means, for example by the addition of a thin layer of clean sediment."⁸⁵ Design and placement of ENR is clearly a construction activity and is treated as such in EPA's cost analysis in the FS. Further, EPA evaluates the chemical isolation properties and protectiveness of ENR in the FS. In Appendix D.6, in particular, EPA compares potential effectiveness of ENR and a cap. EPA concludes that "[b]oth remedial approaches achieve PRGs at the completion of construction."⁸⁶ Therefore, EPA has considered ENR placement as part of construction and has considered the effectiveness of ENR, presumably through calculation of SWAC, but did not reflect this consideration in its risk calculations.

Had EPA considered the benefit of ENR on reducing risk, it would have concluded that ENR should play a larger role in a cleanup for Swan Island Lagoon than provided under Alternative I. Tables in Appendix J of the FS reflect that the post-construction PCB SWAC for Alternative B is about 193 ug/kg.⁸⁷ To estimate the relative effects of ENR, it is possible to recalculate the post-construction SWACs for Alternative B and Alternative I using EPA methods.⁸⁸ Doing so reflects a post-construction SWAC for Alternative B of approximately 27 ug/kg, which is lower than the SWAC that EPA shows for Alternative I.⁸⁹ The corresponding recalculated value for Alternative I is 7 ug/kg, which is below EPA's assumed background level of 9 ug/kg and, therefore, not sustainable over the long term.⁹⁰ These SWAC results demonstrate that considering the benefit of ENR on risk reduction has a real and meaningful impact on the alternatives analysis.

Moreover, as discussed in Appendix A, the potential combination of ENR with GAC—an *in situ* treatment technology similarly ignored by EPA in its risk calculations—is expected to result in a

⁸⁴ See, e.g., *McMaster v. United States*, 731 F. 3d 881, 892 n.5 (9th Cir. 2013) ("Agency inconsistency is 'at most' a reason for concluding that an action is arbitrary and capricious only when the change in position is inadequately explained."); *Nw. Env'tl. Def. Ctr. v. Bonneville Power Admin.*, 477 F. 3d 668, 687 (9th Cir. 2007) ("[A]n agency changing its course must supply a reasoned analysis indicating that prior policies and standards are being deliberately changed"); *Or. Nat. Desert Ass'n v. Bureau of Land Mgmt.*, Civil No. 08-1271-KI, 2011 WL 5830435, at *20 (D. Or. Nov. 15, 2011) ("[A]ny failure of the [agency] to comply with its own agency guidance could be considered arbitrary and capricious.").

⁸⁵ Sediment Guidance, at 4-11.

⁸⁶ 2016 FS, Appendix D, section D6.3, at D-19.

⁸⁷ *Id.* at Appendix J, Table J2.3-7.

⁸⁸ EPA methods were used in the recalculation by assigning dredged or capped surfaces a concentration of 0 ug/kg PCBs. ENR surfaces were assigned a value equal to 15% of the pre-construction sediment concentration, which is the approach used by EPA in the 2015 Draft FS.

⁸⁹ 2016 FS, Appendix J, Table J2.3-1g.

⁹⁰ Indeed, pursuant to Section II(b) of this Appendix, the post-construction SWAC for Alternative B of approximately 27 ug/kg may also be below background for Swan Island Lagoon.

significant risk reduction.⁹¹ GAC, as well as ENR, contribute significantly to the overall costs of the remedies, so evaluation of their contribution to risk reduction should be included in the FS and considered in identification of the most appropriate remedial alternative for the Swan Island SDU.

In short, EPA's approach in the final FS and Proposed Plan defies accepted scientific approaches, as well as common sense, because it completely ignores the benefits of ENR and GAC and the impacts of active and costly remedial efforts. EPA's own analysis in the 2015 Draft FS shows that application of an ENR layer will rapidly reduce the exposure of fish and other food web organisms to PCBs in the Swan Island Lagoon and accelerate reducing risk to humans that may consume fish from this area. By ignoring the effectiveness of ENR (even when amended with GAC) EPA has—without any explanation—reversed course from its prior work product and failed to proceed in accordance with the NCP and applicable agency guidance.

- iii. EPA's PTW designation is inconsistent with the NCP and applicable guidance, is technically unsupported, does not increase overall protectiveness of the remedy, and is inconsistent with other sediment sites

The NCP provides that EPA expects to use "treatment to address the principal threats posed by a site, wherever practicable."⁹² EPA guidance on PTW identifies PTW as "those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur."⁹³

The PTW concept was "established to help streamline and focus the remedy selection process"; it is not "a mandatory waste classification requirement."⁹⁴ "In some situations site wastes will not be readily classifiable as either a principal or low level threat waste and thus no general expectations on how best to manage these source material of moderate toxicity and mobility will necessarily apply."⁹⁵ Further, "[f]or the majority of sediment removed from Superfund sites, treatment is not conducted prior to disposal, generally because sediment sites often have widespread low-level contamination, which the NCP acknowledges is more difficult to treat."⁹⁶

The NCP identifies the following principal threats as those for which treatment "is most likely to be appropriate": liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials.⁹⁷ EPA guidance further expands upon the regulations by listing examples of each type of principal threat (e.g., "liquids" include "waste contained in drums,

⁹¹ Research publications indicate that adding GAC results in more than 90% reduction in PCBs in pore water, and more than 80% reduction in PCB uptake by fish. See Appendix A1 (citing Sun and Ghosh 2007, Ghosh et al. 2011, Fadaei et al. 2015). This represents a significant reduction in mobility, bioaccumulation, and toxicity of sediment contamination. Reduction in potential bioaccumulation in fish contributes directly to reducing exposure and risk to humans consuming fish from the lagoon. See Appendix A1. EPA similarly ignores these conclusions in connection with its PTW designation, discussed in Section II(b)(iii) of this Appendix.

⁹² 40 C.F.R. § 300.430(a)(1)(iii)(A).

⁹³ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, OSWER 9380.3-06FS, *A Guide to Principal Threat and Low Level Threat Wastes* at 2 (Nov. 1991) ("Waste Threat Guide").

⁹⁴ *Id.*

⁹⁵ *Id.*

⁹⁶ Sediment Guidance, at 6-29.

⁹⁷ 40 C.F.R. § 300.430(a)(1)(iii)(A).

lagoons or tanks”) and by identifying low level threat wastes, including “non-mobile contaminated source material of low to moderate toxicity” and “low toxicity source material.”⁹⁸ “Determinations as to whether a source material is a principal or low level threat waste should be based on the inherent toxicity as well as a consideration of the physical state of the material (e.g., liquid), the potential mobility of the wastes in the particular environmental setting, and the lability and degradation products of the material.”⁹⁹

In contrast to these established principles, EPA has designated large geographic areas with relatively low concentrations of COCs that EPA concluded can be reliably contained as PTW, which unnecessarily drives a more expansive and costly remedy. EPA based its PTW designation on its evaluation of the human health fish consumption criteria. However, human health fish consumption is an exposure pathway that is not based on highly toxic criteria and should not be used for PTW “highly toxic” designations.

At the Lower Duwamish Superfund site, EPA concluded that PTW for PCBs did not exist within the site because PCBs in sediments were not highly mobile or highly toxic,¹⁰⁰ despite maximum PCB concentrations in surface and subsurface sediments of 223,000 and 890,000 ug/kg, respectively. These values are more than 1,000 and 4,000 times higher than the “highly toxic” concentration criterion that EPA applied to PCBs in the Portland Harbor FS.¹⁰¹

EPA’s 2016 FS includes new explanations that further demonstrate that EPA’s PTW approach is inconsistent with guidance and flawed. For example, EPA states, “‘Reliably contained’ was not used in identifying PTW, but rather was used to determine what concentrations of PTW could be reliably contained.”¹⁰² This position contradicts EPA guidance, which discusses “reliably contained” as part of PTW identification.¹⁰³ In addition, EPA admits that all COCs (with two exceptions¹⁰⁴) at the concentrations present in the Site can be reliably contained.¹⁰⁵ Thus, none of the areas where these contaminants are absent should be designated as PTW. Instead of applying a PTW designation and correspondingly rigid preference for treatment (or in the case of Portland Harbor, removal), remediation of these contaminants should be assessed according to the standard process for evaluating remedial alternatives under the NCP criteria.

EPA’s approach to designating PTW in Portland Harbor is unique from any other Superfund sediment site. A review of ten large sediment sites shows that EPA’s approach generally avoids prescriptive procedures for identifying and quantifying PTW.¹⁰⁶ These sites are in addition to

⁹⁸ Waste Threat Guide, at 2.

⁹⁹ *Id.*

¹⁰⁰ U.S. Env’tl. Prot. Agency, Record of Decision Lower Duwamish Waterway Superfund Site at 115 (Nov. 2014).

¹⁰¹ 2016 FS, at 3-2-3-6.

¹⁰² *Id.* at 3-3.

¹⁰³ National Oil and Hazardous Substances Pollution Contingency Plan, 55 Fed. Reg. 8666, 8703 (March 8, 1990) (to be codified at 40 C.F.R. 300); Waste Threat Guide, at 2.

¹⁰⁴ Chlorobenzene and naphthalene.

¹⁰⁵ 2016 FS, at Table 3.2-2.

¹⁰⁶ See Memorandum from Walter E. Mugdan, Dir., Emergency and Remedial Response Div., Region 2, U.S. Env’tl. Prot. Agency, to Amy R. Legare, Chair, Nat’l Remedy Review Bd., and Stephen J. Ells, Chair, Contaminated Sediments Tech. Advisory Grp., “Response to National Remedy Review Board and Contaminated Sediments Technical Advisory Group Recommendations for the Lower Eight Miles of the Lower Passaic River, part of the Diamond Alkali Superfund Site in Newark, New Jersey (April 11, 2014) (“According to the guidance, ‘the principal threat/low level threat waste concept and the NCP expectations were established to help streamline and focus the remedy selection process, not as a mandatory waste classification requirement’ (p. 2) . . . In preparing the FFS [Focused Feasibility Study] for the lower 8.3

the Lower Duwamish, where EPA Region 10 itself took an essentially opposite approach to PTW than at Portland Harbor. EPA has failed to provide any reason or basis for why Portland Harbor should be treated differently from these other sites.

In sum, blanket identification of large areas of relatively low concentration sediments as PTW is neither required by the NCP nor necessary to protect public health or the environment. EPA's current proposed approach for addressing PTW is inconsistent with data at the Site, contrary to precedent and approach at other sites, and not cost effective relative to risk reduction.

iv. The Proposed Plan fails to account for reasonable, site specific exposure scenarios

The primary driver of EPA's proposed remedy in Terminal 4 is attributable to direct contact human health exposure from polycyclic aromatic hydrocarbons (PAHs) (RAO 1—Protection of humans from direct contact and ingestion of contaminated sediments). This is different from the exposure scenario driving cleanup in most of the rest of the Site, which is fish consumption risk from PCBs and other contaminants that bioaccumulate in the fish tissue that people consume. However, as discussed in Appendix B, EPA's assessment of risk associated with direct contact and ingestion of sediment is based on exposure assumptions that do not exist at Terminal 4.

For example, with regard to fishers, EPA assumes that an individual fishing with hook and line will fish 260 days per year for 70 years, covering his or her hands and forearms with sediment

miles of the Lower Passaic River, the Region concluded that the principal threat/low level threat waste concept does not help streamline and focus the remedy selection process."); U.S. Env'tl. Prot. Agency, DCN HR-080212-AARX SMS 518898, *Regional Response to the National Remedy Review Board Comments on the Site Information Package for the General Electric (GE)-Pittsfield/Housatonic River Project, Rest of River* at 5 (Aug. 3, 2012) ("EPA's Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA, 2005) states that although the NCP provides a preference for treatment for 'principal threat waste', [sic] treatment has frequently not been selected for contaminated sediment. High costs, uncertain effectiveness, and/or community preferences (for on-site operations) are factors that lead to treatment being selected infrequently at sediment sites Also, it should be recognized that in-situ containment can also be effective for principal threat wastes, where that approach represents the best balance of the NCP nine remedy selection criteria."); U.S. Env'tl. Prot. Agency and Wis. Dep't of Nat. Res., *Record of Decision for Operable Unit 1 and Operable Unit 2 Lower Fox River and Green Bay, Wisconsin* at 80 (Dec. 2002) ("With respect to the Fox River sediments in OU 1, some PCB concentrations create a risk in the range of 10^{-3} or more. The preference for treatment outlined above applies to these particular sediments. However, it would be impracticable to closely identify, isolate and treat these principal threat wastes differently than the other PCB sediments in OU 1. The dredging technology that will be employed to accomplish the OU 1 remedy does not distinguish among gradations of contamination in source materials. Nevertheless, at the conclusion of the OU 1 remedy the source materials (and principal threat wastes) will have been removed from the River, dewatered, and deposited in a landfill. In so doing the mobility of the principal threat wastes will have been greatly reduced."); U.S. Env'tl. Prot. Agency, *Record of Decision Grasse River Superfund Site* at 49 (April 2013) ("EPA does not believe that treatment of the principal threat wastes is practicable or cost effective given the widespread nature of the sediment contamination and the high volume of sediment that would need to be addressed."); U.S. Env'tl. Prot. Agency and N.Y. State Dep't of Env'tl. Conservation, *Record of Decision Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site* at 71 (July 2005) ("Given the extraordinary volume of materials being evaluated (e.g., greater than 4,000,000 cy [3,060,000 m³] of sediments and wastes within the ILWD [in lake waste deposit], some of which contain NAPLs), treatment of all principal threat wastes (which are present in various portions of the ILWD) is impracticable. However, the implementation of any of these alternatives would include the off-site treatment and/or disposal of all NAPLs that would be segregated during the dredging/handling process. The appropriate means for collecting and handling these sediments and materials would be determined during the remedial design.").

each time, and ingesting that sediment each time.¹⁰⁷ As to divers, EPA assumes five dives per year in wet suits for 25 years (i.e., 125 dives per individual), with substantial coverage of the diver's *entire body* with contaminated sediment during each dive. These are unreasonable assumptions standing on their own. When actual site-specific exposures and reasonably anticipated future use are considered, it is demonstrated that there is no reasonable risk via this pathway.

Terminal 4 is an active, secured marine terminal. The protocols described in Appendix B2, including the Port's Facility Security Plan and Security Standard Operating Procedure, combined with the Port's site management of future land uses, prevent the types of exposure scenarios assumed by EPA, and thereby serve as de facto institutional controls (ICs).

ICs generally refer to non-engineering instruments, such as administrative and legal controls, intended to affect human activities in such a way as to prevent or reduce exposure to hazardous substances, often by limiting land or resource use.¹⁰⁸ The four general categories of ICs are: governmental controls; proprietary controls; enforcement and permit tools with IC components; and information devices.¹⁰⁹ The three most common types of ICs at sediment sites include fish consumption advisories and commercial fishing bans, waterway use restrictions, and land use restriction/structure maintenance agreements.¹¹⁰

The NCP sets forth the following general EPA expectations with regard to ICs:

EPA expects to use institutional controls such as water use and deed restrictions to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants, or contaminants. Institutional controls may be used during the conduct of the [RI/FS] and implementation of the remedial action and, where necessary, as a component of the completed remedy.¹¹¹

The Sediment Guidance acknowledges that these expectations generally apply to all Superfund sites, including sediment sites, and ICs are "common parts of sediment remedies."¹¹² EPA must consider reasonably anticipated future land use during response selection and take it into account when selecting ICs.¹¹³

¹⁰⁷ Furthermore, EPA modified, without explanation, certain direct contact/ingestion parameters from the values that were previously approved in the baseline human health risk assessment (BHHRA; Kennedy-Jenks 2013). For example, the incidental sediment ingestion rate was increased from 50 to 100 mg/day, and the site use factor was increased from 25 to 100 percent. EPA's modifications increase the *perceived* risk but do not provide a reasonable representation of the actual exposures at Terminal 4. See Appendix B.

¹⁰⁸ *Id.* at 3-22–3-23.

¹⁰⁹ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, EPA 540-F-00-005, OSWER 9355.0-74FS-P, *Institutional Controls: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups* at 3 (Sept. 2000).

¹¹⁰ Sediment Guidance, at 3-23.

¹¹¹ 40 C.F.R. §300.430(a)(1)(iii)(D).

¹¹² Sediment Guidance, at 7-14.

¹¹³ Office of Solid Waste and Emergency Response, U.S. Env'tl. Prot. Agency, EPA 540-R-09-001, OSWER 9355.0-89, *Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites* at 3 (Dec. 2012). The 2012 Institutional Controls Guidance also provides that EPA should review state or local laws and regulations as they pertain to ICs at a

The Port's protocols constitute governmental controls, as they impose "restrictions on land or resource use using the authority of a government entity."¹¹⁴ They fall within the common types of ICs employed at sediment sites to restrict waterway use and are necessary to ensure public safety and security. To the extent EPA believes it is necessary to further formalize the controls in connection with the remedial action, the Port is willing to discuss a common understanding with EPA and/or layering the IC to ensure protectiveness of the response action.¹¹⁵

In the meantime, actual site-specific exposures and observations discussed in Section II.B of the Port's comments and Appendix B demonstrate that current and future marine terminal uses make fishing improbable, long-time Port employees have not observed meaningful amounts of fishing occurring in Terminal 4, Port security protocols are implemented to prevent fishing, and the actual commercial diver exposures at Terminal 4 are at least an order of magnitude less than EPA's assumptions, indicating there is no significant risk to commercial divers. Therefore, EPA should make a site-specific risk management decision in the ROD that human direct contact risk is inapplicable to remedy selection and design at Terminal 4. It would be arbitrary and capricious to mandate a remedial action that does not serve to reduce any risk to human health or the environment.¹¹⁶

v. EPA's benthic PRGs are unreliable

Absent human health risk drivers for cleanup of PAHs at Terminal 4, risk to benthic organisms becomes the primary driver for assessing the need for additional PAH cleanup. The risk to benthic organisms from contact with Terminal 4 sediments was substantially addressed as a result of the early action, as shown in Appendix B. Any remedy should build on the success of this early action. Nevertheless, the Port recognizes that there may be residual risks to benthic organisms associated with PAH contamination, in particular at Slip 3.

However, as discussed in the LWG Comments¹¹⁷ and in Appendix B, years of work by the LWG to identify harbor-wide benthic risk areas using technically supportable methods and multiple lines of evidence were discarded without explanation when EPA introduced, for the first time in its Proposed Plan, a completely new and thoroughly unsupported method for analyzing harbor-wide benthic risk. EPA departed from commonly accepted technical principles in its analysis, which:

- oversimplifies the benthic risk analysis down to a single line of evidence by inappropriately combining multiple lines of evidence and disregarding others;
- biasedly selects benthic PRGs;

specific site if the site manager is considering relying on or utilizing a state or local law to put ICs in place.
Id. at 23-24.

¹¹⁴ *Id.* at 4.

¹¹⁵ See *id.* at 9, 10 ("Layering can involve using different types of ICs at the same time to help ensure the protectiveness of the response action;" a "common understanding" is a mechanism to memorialize the respective IC roles and responsibilities of the parties).

¹¹⁶ *In re Bell Petroleum Services, Inc.*, 3 F.3d at 906 (concluding that EPA's decision to provide an alternate water supply was arbitrary and capricious and a waste of money, where there was no evidence in the administrative record that anyone in the area was actually drinking chromium-contaminated water, and as such, the alternate water supply did not even reduce, much less eliminate, any public health threat).

¹¹⁷ LWG Comments, Section I(A).

- misapplies PRGs by disregarding important site-specific information and undermining their reliability;
- misuses undetected values; and
- arbitrarily applies unsupported factors to reduce the size of the effective remediation areas in an attempt to correct an untenable result.

EPA's arbitrary, result-driven approach leads it to an unsupported conclusion in the FS and Proposed Plan that Alternatives B and D may not be protective,¹¹⁸ a result that is itself flawed since each of EPA's alternatives at this stage is legally required to meet the threshold protectiveness criterion. It further leads to benthic PRGs that are incompatible with existing Terminal 4 chemical and biological data, including data obtained during the Terminal 4 RI, engineering evaluation/cost analysis, and early action investigations.

The Comprehensive Benthic Risk Area approach that EPA and LWG developed collaboratively is well-supported, and there is no reason for EPA not to return to it. However, to enable an equally protective, cost-effective remedy to move forward at Terminal 4, the Port believes EPA should adhere to its previous positions that site-specific toxicity testing be considered the most definitive information for defining benthic risk areas in remedial design.

vi. Updated data were not considered before issuing the Proposed Plan

1. EPA ignored relevant data

EPA selectively ignored data to support its conclusions in the FS and Proposed Plan. In 2012, EPA requested that the LWG collect additional fish tissue samples from the site to help update the site database.¹¹⁹ In its letter, EPA stressed the importance of the data as a baseline for future evaluations. The LWG agreed to the request, and collected small mouth bass samples throughout much of the harbor as directed by EPA.

However, EPA subsequently ignored the 2012 data in evaluating PRGs and development of remedial alternatives in the FS and Proposed Plan even though the results showed significantly lower PCB concentrations in many areas of the Site. EPA then *selectively* used the data to support its conclusion that natural recovery at the site was slow or non-existent.¹²⁰ But in this analysis, for unexplained reasons, EPA uses only the 2007 and 2012 fish tissue data (and ignores the 2002 tissue data), which essentially halves the available time period that can be evaluated. EPA's discussion is heavily focused on finding any potential evidence of a "zero" trend, which is a bias caused by EPA's simplistic and static conceptual site model.

The potential importance of updated data is illustrated by the small mouth bass data for the Swan Island SDU. PCB concentrations for small mouth bass collected from the Swan Island SDU in 2012 were approximately 6.7-fold lower than the concentrations in the 2002/2007 bass tissue data that were used in RI and baseline risk assessments. Fish tissue samples collected in 2002/2007 result in a mean PCB concentration of 3,026 ug/kg; the mean for the 2012 samples is 447 ug/kg. This difference represents a drop in EPA's projected PCB cancer risk from fish ingestion (RAO 2) from $2\text{E-}4$ ¹²¹ to $3\text{E-}4$. This change drops the projected cancer risk for Swan Island SDU to a level near the EPA's target risk range ($1\text{E-}6$ to $1\text{E-}4$). Since there has been no sediment remediation or navigation dredging in contaminated parts of the SDU, this

¹¹⁸ See 2016 FS, at ES-15, 4-8, 4-88-4-89, 4-98.

¹¹⁹ Letter from Kristine Koch, US. Environmental Protection Agency to LWG (July 26, 2012).

¹²⁰ 2016 FS, Section 3.6.1.3.

¹²¹ 2016 FS, Table J2.3-8a.

decline in fish tissue PCB concentrations and risk could be due to site-specific source control efforts, natural recovery, or a combination of factors that reduce the PCB concentration in surface water and sediment. At a minimum, this level of change represents an important and fundamental factor that should be considered in the remedial alternative for Swan Island.

2. EPA uses old data to assign remedial technologies, without sufficient flexibility to incorporate new data

As discussed in Appendix B, the majority of the PCB contamination at Terminal 4 is found in two isolated locations, each represented by a single sample collected 12 years ago in 2004.¹²² One of these samples¹²³ is already covered by a foot of relatively clean material,¹²⁴ providing evidence of sediment stability and natural recovery at this location. Furthermore, these anomalous and isolated PCB concentrations decrease by an order of magnitude or more in all directions, and have never been replicated or confirmed.

Given the time that has passed since their collection, these samples are not likely representative of current site conditions.¹²⁵ However, that is exactly how they were used by EPA in the Proposed Plan and FS to determine risk associated with RAO 2 (consumption of fish and shellfish). Additional data needs to be collected during pre-remedial design to determine whether the elevated PCB concentrations are still present, and if so, to better delineate the extent of these localized deposits and determine an appropriate remedial response. For example, EPA acknowledges in the Proposed Plan that updated data will be required to define the RAL footprint, and information or data gaps should be addressed during remedial design. The ROD should reflect this need by incorporating an appropriate level of flexibility in decision-making. Specifically, the harbor-wide decision tree applicable to Terminal 4 should allow site-specific data to drive remedial design and remedial action decision-making in the manner recommended in Section III.b below.

c. The Proposed Plan is Inconsistent with CERCLA and the NCP because EPA's Analysis of Remedial Alternatives is Incomplete, Misleading, and Subjective

Remedy selection from among a range of protective alternatives must be based on a credible, objective, quantitative evaluation of the NCP criteria. After each alternative is evaluated against the NCP criteria, they must then be compared against each other to gauge their relative effectiveness to reduce risk.¹²⁶ Cost plays an integral role in the Superfund remedy selection process. Under both CERCLA and the NCP, the selected remedy must be determined to be cost effective, i.e., a remedy's costs are proportional to its overall effectiveness.¹²⁷

¹²² Surface sample T4-VC13 (820 ug/kg) at 0 to 1 ft. depth on the southwest slope of Slip 1 (2016 FS, Figure 1.2-6a); subsurface sample T4-VC29 (1,000 ug/kg) at 1 to 3 ft. depth in the southeast part of Slip 3 (2016 FS, Figure 1.2-6b).

¹²³ Subsurface PCB contamination in T4-VC29.

¹²⁴ 42 ug/kg.

¹²⁵ See USACE, EPA et al. 2016, Section 3.5.1 (Sediment Evaluation Framework requires re-sampling every three years in areas like Portland harbor for dredged material characterization).

¹²⁶ Preparing Proposed Plan Guidance, at 1-5.

¹²⁷ LWG NRRB Comments, at 30; 42 U.S.C. § 9621(b)(1). The NCP preamble explains, "[i]n analyzing an individual alternative, the decision-maker should compare . . . the relative magnitude of cost to effectiveness of that alternative. In comparing alternatives to one another, the decision-maker should examine incremental cost differences in relation to incremental differences in effectiveness." 55 Fed. Reg. 8728. Furthermore, "if the difference in effectiveness is small but the difference in cost is very large, a

Of course, before evaluating remedial alternatives under the NCP balancing criteria, EPA must identify remedial alternatives that meet the threshold criteria of protectiveness and compliance with ARARs.¹²⁸ As discussed in the LWG Comments, in the Proposed Plan, EPA instead arbitrarily concluded without supportable analysis that Alternatives B and D from the FS may not be protective because of a perceived risk to ecological receptors that could not be managed during periods of natural recovery before the alternatives meet PRGs.¹²⁹ EPA did not present a basis for distinguishing its treatment of Alternatives B and D from Alternative I, given that many of the same perceived ecological risk factors apply.¹³⁰ As such, EPA's analysis is arbitrary and capricious because it eliminates Alternatives B and D from consideration and any meaningful balancing of the NCP criteria and cost-effectiveness analysis. EPA's analysis of the NCP-required balancing criteria and cost-effectiveness are also deficient for the reasons described below.

i. EPA's evaluation of remedial alternatives against the NCP-required balancing criteria lacks basic building blocks

The first step in the development of an effective and appropriately grounded alternatives assessment is the careful crafting of criteria for the purpose of analyzing and evaluating both cost and benefit. "The evaluation should consider both positive effects, such as long-term effectiveness as measured through risk reduction, and negative effects, such as the adverse effects associated with implementation."¹³¹ EPA has inappropriately neglected this exercise with an incomplete, subjective, and largely qualitative assessment.

1. The Proposed Plan fails to adequately consider long-term effectiveness and permanence

Rather than quantitatively evaluating long-term effectiveness, EPA has developed a new approach of evaluating alternatives using only "interim targets." The "interim targets" are essentially 10 times the PRGs.¹³² EPA then compares post-construction risks to these interim targets for evaluating the "overall protection of human health and the environment" for each alternative.¹³³ Apparently, EPA hypothesizes that if alternatives meet these interim targets, it is reasonable to assume the PRGs will be met through subsequent natural recovery in 30 years.¹³⁴ EPA's approach is arbitrary and capricious.

EPA provides no evidence to support a relationship between its interim targets and achievement of the PRGs (which, for PCBs, no alternative will achieve over the long term, as discussed above). EPA assumes that all alternatives will achieve the PRGs within a reasonable time frame—i.e., 30 years.¹³⁵ EPA asserts that Alternative I is more likely to achieve PRGs than

proportional relationship between the alternatives does not exist," and "[t]he more expensive remedy may not be cost-effective." *Id.*

¹²⁸ LWG Comments, Section V(A).

¹²⁹ Discussed at Section II(b)(v) of this Appendix; see also LWG Comments, Section I(A).

¹³⁰ Alternative I itself does not meet some of the interim targets. Figure 4.2-6 shows that none of the alternatives even come close to the ten times PRG levels. EPA's selection of Alternative I over the other alternatives notwithstanding this fact is arbitrary. See also LWG Comments, Section I(A).

¹³¹ ITRC (Interstate Technology & Regulatory Council). 2014. Contaminated Sediments Remediation: Remedy Selection for Contaminated Sediments (CS-2). Washington, D.C.: Interstate Technology & Regulatory Council, Contaminated Sediments Team. http://www.itrcweb.org/contseds_remedys-selection.

¹³² LWG Comments, Section I(A).

¹³³ *Id.*

¹³⁴ *Id.*

¹³⁵ See draft Final FS, at. 4-6, see also LWG Comments, Section I(A), IV(D), V(C).

alternatives that actively remediate smaller areas. However, EPA provides no explanation or evidence that one remedy alternative achieves risk reduction or attains PRGs in a substantially shorter time than other alternatives.¹³⁶

This is not to discount the level of uncertainty and complexity that EPA must manage in assessing the effectiveness of remedial alternatives within a large and dynamic environment. An appropriate response to uncertainty could be to employ adaptive management consistent with EPA national guidance, as discussed below. EPA told the National Remedy Review Board (NRRB) that it would continue to work on models to be used during implementation.¹³⁷ Those models could be used to assess the performance of a less aggressive initial remedy to determine whether additional active remedy in certain areas is required. However, EPA instead managed uncertainty in remedy selection by arbitrarily choosing a more aggressive, prescriptive remedy without evidence of any material increase in protectiveness when compared to a less aggressive approach. To meet the legal requirements for remedy selection, EPA needed to find some reasonable, quantitative basis to compare rates of risk reduction or recovery to evaluate relative effectiveness or use a less aggressive initial remedy and a more flexible approach that allows it to test hypotheses and develop increased certainty about the information supporting its remedy decisions as the remedy is implemented.¹³⁸

To select a more prescriptive, less flexible remedy, EPA needed make an assessment of relative effectiveness of remedial alternatives over time that would allow it to evaluate trade-offs among the required NCP criteria. EPA had the tools to do this. As explained in LWG Comments,¹³⁹ EPA assumed that all alternatives would meet the PRGs within 30 years. This assumption implies, for PCBs, a half-life of ten years, which results in a rate of natural recovery consistent with empirical evidence from 2012 fish tissue (which EPA ignored). This simple analysis shows that the different remedial alternatives may achieve similar Site-wide SWACs within five years of one another—the green cells in the table below.¹⁴⁰ Table 6 from LWG Comments uses EPA's assumptions for initial SWAC, construction durations, and post-construction SWAC, but recognizes that no remedy will achieve outcomes lower than a reasonable equilibrium level of 20 ppb, meaning that more intensive alternatives do not achieve better long term outcomes.¹⁴¹

¹³⁶ LWG Comments, Section I(A), IV(D), V(C).

¹³⁷ Region 10 response to NRRB: "The Region understands the boards' concerns and is continuing to explore the use of site specific predictive models that will aid in the management during remedy implementation. Some of those tools will include fish tissue trend data, sediment fate and transport models, or sediment trend data." Memorandum from Sheila Fleming, Acting Dir., Office of Environmental Cleanup, Region 10, U.S. Env'tl. Prot. Agency, to Amy R. Legare, Chair, Nat'l Remedy Review Bd., and Stephen J. Ells, Chair, Contaminated Sediments Tech. Advisory Grp., "Region 10 Responses to National Remedy Review Board and Contaminated Sediments Technical Advisory Group Recommendations for the Portland Harbor Superfund Site", at 14 (January 21, 2016).

¹³⁸ See LWG Comments, Section IV(A), (C) and (D). "Project managers are encouraged to use an adaptive management approach, especially at complex sediment sites, to provide additional certainty of information support decisions. In general, this means testing hypotheses and conclusions, and reevaluating site assumptions as new information is gathered." Sediment Guidance at 2-22.

¹³⁹ See generally LWG Comments, Sections III, IV(D), and V.

¹⁴⁰ LWG Comments, Section V(C) at Table 6.

¹⁴¹ *Id.*

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LWG Comments, Table 6

Table 6. PCB SWACs (ppb) Comparison Using EPA's 24 hour/day Assumption for Alternative Durations (using EPA's 2016 initial SWAC of 208 ppb).

EPA Alternatives	Years																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A (no action)	208	194	180	168	156	145	135	126	117	109	101	94	88	82	76	71	66	61	57	53	49	46	43	40	37	35	32	30	28	26
B				74	69	64	60	56	52	48	45	42	39	36	34	31	29	27	25	23	22	20	20	20	20	20	20	20	20	20
D					56	52	49	45	42	39	36	34	32	29	27	25	24	22	20	20	20	20	20	20	20	20	20	20	20	20
E/I							40	37	35	32	30	28	26	24	23	21	20	20	20	20	20	20	20	20	20	20	20	20	20	20
F													23	21	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
G																			20	20	20	20	20	20	20	20	20	20	20	20

Notes

Duration of alternative construction

XX Year construction is completed and EPA estimated SWAC at that time.

XX Using an estimated natural recovery rate, the years that the alternative achieves a concentration approximately equivalent to the LWG-estimated site-wide equilibrium concentration of 20 ppb within a factor of plus 20% (i.e., plus or minus 20% is the EPA acceptable analytical accuracy for organic compounds). This equates to a concentration range of 20 to 24 ppb (i.e., 24 ppb is plus 20% of the equilibrium value of 20 ppb).

Rather than estimating long-term effectiveness over a reasonable time frame that includes recovery post-construction, EPA's figures measure effectiveness only immediately following construction (i.e., using only the blue highlighted cells)—which, of course, is much later for some alternatives than others.¹⁴²

Note that none of EPA's estimates of Site-wide SWAC, nor those used in this table, include an estimate of risk reduction from application of ENR in Swan Island Lagoon. This omission is arbitrary and capricious for the reasons discussed above.

EPA's remedy selection is legally deficient, as well as arbitrary and capricious, not because the above analysis is the only plausible way to evaluate and compare the long-term effectiveness of remedial alternatives. It is because this and other analyses in the record¹⁴³ provide the only technical basis in the administrative record for assessing long-term effectiveness. Thus, the only evidence in the record demonstrates that effectiveness trade-offs among alternatives may come down to a handful of years of difference, in a process that has been going on for 16 years. (And this is before even considering short-term impacts that *worsen* risks to human health and the environment during construction.)

It would be arbitrary and capricious for the ROD to select a prescriptive remedy without meaningfully engaging with the possibility that the selected remedy offers minimal benefits over less resource- and time-intensive alternatives, or offering meaningful flexibility in the remedy approach to take smaller initial actions and then assess performance.

2. The Proposed Plan fails to adequately consider reduction of toxicity, mobility, or volume

As discussed above, EPA has provided no quantitative evaluation of the effect of ENR or GAC on reducing PCB concentrations in fish tissue, and no criteria for evaluating the effectiveness of the remediation. EPA identified ENR as an applicable technology for Swan Island, stating that ENR is expected to meet RAOs.¹⁴⁴ However, despite EPA's conclusions regarding the

¹⁴² See LWG Comments, Section I(C)(2), IV and V(C).

¹⁴³ Both EPA and LWG presented more complex predictive models during the FS development process. EPA ceased efforts to further refine or develop these models. See LWG Comments, Section IV(D).

¹⁴⁴ EPA 2016b; p. 3-31.

applicability and effectiveness of ENR in the Swan Island Lagoon environment, EPA has ignored the impact of ENR or GAC on calculating levels of risk reduction.

Pilot studies at other sites, as well as research publications, indicate that adding GAC results in more than 90% reduction in PCB concentrations in pore water, and more than 80% reduction in PCB uptake by fish.¹⁴⁵ This represents significant reduction in mobility, bioaccumulation, and toxicity of sediment contamination.

EPA's failure to evaluate the benefit of these actions on risk reduction has a critical impact—it results in an incomplete analysis for each alternative in the FS and, therefore, prevents any meaningful comparison among the alternatives in accordance with the NCP.¹⁴⁶ Appendix A demonstrates that had EPA considered the benefit of ENR on reducing risk, it would have concluded that ENR should play a larger role in the cleanup than provided under Alternative I.

3. The Proposed Plan fails to adequately consider short-term effectiveness

The Proposed Plan and FS fail to present a comprehensive and quantitative evaluation of dredging releases, the impacts on short-term effectiveness during dredging, and the associated increases in both human health and ecological risks.¹⁴⁷

EPA guidance strongly recommends a comprehensive and quantitative evaluation of dredge release impacts, but EPA performed none of this evaluation in the FS. EPA's attempt to point to the Hudson River project as the basis for its assumption that contaminant releases during dredging in Portland Harbor will be only 1% of the total contaminant mass dredged is a red herring, because, among other reasons, physical and chemical conditions at the sites are entirely different.¹⁴⁸ Thus, EPA is not making an apples to apples comparison. In the 2012 Draft FS, the LWG provided a review of six recent projects showing that dredge releases are more likely in the 3% range.¹⁴⁹

EPA does indicate that, during construction, the amount of resident fish that can be consumed safely from the river will sharply decline, presumably due to dredge releases. Also, benthic communities will be disturbed. By focusing its effectiveness analysis only on the post-construction risks, EPA neglects any quantitative measure of the negative impacts that occur during construction.¹⁵⁰

Under EPA's assumptions, Alternative B takes four years to construct and Alternative I takes seven years; however, under more reasonable construction duration assumptions, discussed below, the time frames would double.¹⁵¹ By the time Alternative I reaches completion of

¹⁴⁵ See Appendix A1 (citing Sun and Ghosh 2007, Ghosh et al. 2011, Fadaei et al. 2015).

¹⁴⁶ See LWG Comments, Section I.

¹⁴⁷ See Sediment Guidance, at 7-13–7-14 (consideration should be given not only to risk reduction associated with reduced human and ecological exposure to contaminants, but also to risks introduced by implementing the alternatives), *see also* LWG Comments, Section I(D) and IV(C).

¹⁴⁸ See LWG Comments, Section IV(C).

¹⁴⁹ *Id.*

¹⁵⁰ *Id.*

¹⁵¹ See LWG Comments, Section IV(F).

construction in a reasonable estimate of 14 years, Alternative B may already have reached comparable SWACs due to natural recovery.¹⁵²

In that scenario, Alternative B would also have spared the ecosystem and the community five years of elevated concentrations from dredging, disturbance of benthic communities and construction impacts. In other words, less intensive alternatives may reach similar SWACs in similar time frames; they also reduce impacts from remedy construction and thereby improve the remedy's short-term effectiveness compared with remedies that take longer to construct.¹⁵³ This type of comparison is largely absent from EPA's analysis.

This missing analysis hides concrete, real world differences among alternatives that should be significant to the public. As described in the LWG Comments,¹⁵⁴ when considering relative short-term impacts, EPA's Alternative I would only allow for minimal increase in the average fish meals per year over the entire 30-year period as compared to Alternative B (approximately one meal per year more for the child scenario used in EPA's Proposed Plan, and less than five meals per year more for the adult scenario),¹⁵⁵ but with substantially greater construction impacts, duration, and cost.

4. The Proposed Plan fails to adequately consider key implementability issues

The Proposed Plan and FS contain various assumptions regarding the ability to implement the remedy, which are unsupportable and unrealistic. For example:

- EPA implies that residual covers should be applied on a daily basis. However, this requirement is without precedent for a project of this scale. Further, contrary to EPA guidance, the impacts of such an approach on costs and duration of the alternatives are not quantified or further evaluated.¹⁵⁶
- Construction durations are significantly underestimated in EPA's analysis. LWG's review demonstrates that EPA's dredge production volumes, based on assumptions of 24/7 dredging using incorrect dredging technology and less constrained offloading capacity, are significantly higher than what is feasible in Portland Harbor. The LWG assumed 1,600 cubic yards per day of dredging and 104 construction days per season, while EPA assumed 5,100 cubic yards per day of dredging and 122 construction days per season. As a result of these and other assumptions, LWG assumes that construction durations for each alternative are roughly double what EPA assumed—meaning that Alternative I would take 14 years, not 7 years, to construct.¹⁵⁷

¹⁵² Even more arbitrary than EPA's decision not to estimate risk reduction from monitored natural recovery is EPA's decision not to calculate risk reduction from application of ENR, discussed in Section II(b)(ii) of this Appendix.

¹⁵³ See LWG Comments, Section III.

¹⁵⁴ LWG Comments, Sections I(D) and V(C).

¹⁵⁵ LWG Comments, Table 8.

¹⁵⁶ Sediment Guidance, at 6-22, 6-23 ("Project managers should be aware that most engineering measures implemented to reduce resuspension also reduce dredging efficiency. Estimates of production rates, cost, and project time frame should take these measures into account." "The strategy for the project manager should be to minimize the resuspension levels generated by any specific dredge type, while also ensuring that the project can be implemented in a reasonable time frame.").

¹⁵⁷ LWG Comments, Section IV(F).

- The FS implies that sheet piles will be installed in the navigation channel, which would infeasibly obstruct vessel traffic. Sheet pile would also impact ongoing water dependent operations and nearshore fish migration. EPA does not consider the inability to remove contaminated material within the crenulations of the containment barrier and does not evaluate whether sheet piles in the navigation channel could be permitted by United States Army Corps of Engineers or allowed by the United States Coast Guard as possible hazards to navigation in an active vessel traffic lane. There is also no consideration of whether or not such devices are technically feasible given flow conditions, sediment depths, water depths, or the need to place them and remove them almost continuously to accommodate vessel traffic if dredging in a navigation channel.¹⁵⁸

5. EPA has materially underestimated costs

EPA's estimate of the cost of its proposed remedy (\$750 to \$811 million, depending on the disposal scenario) falls well outside the required accuracy range for FS cost estimates of -30 to +50%. An accurate estimate demonstrates that EPA's proposed remedy is more likely to cost close to \$1.8 billion—more than double EPA's estimate.¹⁵⁹ The areas of difference most significant to the overall discrepancy between EPA's and LWG's cost estimates include volume estimates for dredging and capping, use of sheet pile walls, mobilization and demobilization, and design and contingency cost percentages.

- ii. Errors in the evaluation of NCP-required criteria prevent a conclusion that Alternative I is cost-effective

The result of the above errors is a defective basis for an alternatives evaluation.¹⁶⁰ To justify adopting its preferred alternative as a prescriptive, inflexible remedy in the ROD, EPA must address these errors, as well as correct significant flaws in the next stage of the analysis—whether increasingly resource-intensive and costly alternatives deliver meaningfully better risk reduction. Specifically, EPA should:

- consider how sensitive its conclusions are to its chosen starting point—i.e., to the assumption about current concentrations;
- compare, on a consistent scale, when alternatives will achieve comparable levels of risk reduction and/or meet the cleanup goals;
- communicate incremental risk reduction from one alternative to the next in terms that are transparent to the public and relevant to the remedial action objectives—e.g., by reference to the increased amount of resident fish that can be consumed safely; and
- perform a cost effectiveness analysis in accordance with CERCLA and the NCP.

There is evidence in the administrative record to enable a reasonable analysis of each of these elements, and analysis based on that evidence does not support EPA's preferred remedy.

Sensitivity to initial conditions. In explaining the relative effectiveness of alternatives, EPA has used a "knee of the curve" graph that plots each alternative's estimated SWAC at completion of construction relative to remedy cost. This type of graph shows the break-point at which more

¹⁵⁸ LWG Comments Section IV(C).

¹⁵⁹ LWG Comments Section IV(F). See also LWG, EPA Cost Evaluation Memorandum (Aug. 29, 2016) (presenting a side-by-side comparison of EPA's approach to major cost items with LWG's approach.)

¹⁶⁰ Table 15 of the Proposed Plan summarizes EPA's inadequate comparison evaluation of alternatives. See Proposed Plan, at Table 15.

intensive alternatives no longer achieve significant risk reductions. Changing the starting point—i.e., the SWAC calculated for Alternative A, the no action alternative—markedly changes the break-point. EPA's 2016 figures more than double the starting SWAC—to 208 ppb PCBs—from the value it used in its 2015 Draft FS—85 ppb PCBs. Using a starting point of roughly half the 2015 value—40 ppb PCBs, which could be plausible based on 2012 data that EPA did not consider—shows how different the break-point can be under different initial conditions. Figure 3 from the LWG Comments illustrates the difference in break-points when using these different SWAC starting points. EPA should explain how it intends to make its remedy approach flexible enough to deal with uncertainty on this material factor, which will be informed by the data collection that EPA expects to occur immediately after the ROD.

Compare alternatives' performance on a consistent time scale. As discussed above, EPA had tools to estimate how different construction durations and assumptions about the rate of natural recovery would affect its conclusions about long- and short-term effectiveness. Using an estimate based on EPA's own assumptions demonstrates that such an analysis would reflect comparable risk reduction from all alternatives.

Communicate risk reduction benefits among alternatives in real terms. In EPA's measures of relative effectiveness, the SWAC and the corresponding cancer and noncancer risks (at time zero) are commonly the units of measurement. EPA does not emphasize the consequences of those outcomes for the primary risk that the remedy is designed to reduce—consumption of resident fish. EPA should be transparent about its estimates of how many fish meals per month or year—or 10 years, according to EPA's new metric—different alternatives allow to be consumed safely over the next 30 years and beyond. As shown in Sections I(D) and V(C) of the LWG Comments, the differences are highly uncertain and may be vanishingly small.

Adequate analysis of all of these elements is required to demonstrate, as required by CERCLA and the NCP, that the remedy is cost-effective—meaning that its costs are proportional to its overall effectiveness. EPA failed to perform even a perfunctory cost-effectiveness analysis and only purported to compare Alternatives E and I. Even as to Alternatives E and I, the Proposed Plan devotes less than a page to the comparison, which is insufficient to comply with CERCLA and the NCP's requirements that the selected remedy be cost-effective.¹⁶¹

A quantitative assessment of cost-effectiveness based on the analyses of long-term effectiveness presented above and missing from EPA's analysis shows that the increased cost of dredge-intensive remedies, including Alternatives E and I, is not proportional to increased effectiveness when compared with less costly alternatives.

Figure 7 from LWG Comments shows the relative additional effectiveness (as represented by SWACs) of each successively bigger alternative, as compared to incremental increases in the costs¹⁶² of those alternatives.¹⁶³ When looking only at effectiveness immediately after construction—which, again, is much later for some alternatives than others—there appear to be meaningful improvements from more costly alternatives (red line).¹⁶⁴ However, looking at effectiveness estimates at a later date—Year 19, when EPA expects construction of Alternative G would be complete—shows no meaningful increase in effectiveness (yellow line).¹⁶⁵

¹⁶¹ *Id.* at 67.

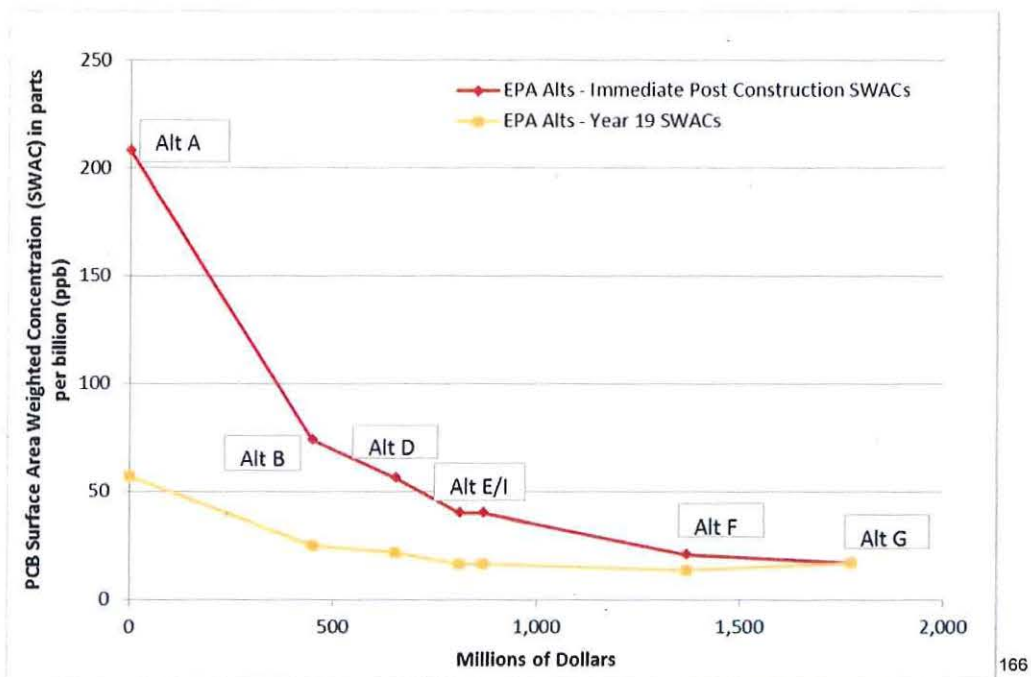
¹⁶² Cost estimates are reflected based on EPA's 2016 FS, which, as discussed in Section II(c)(i)(5) of this Appendix, underestimate the true costs of the alternatives.

¹⁶³ LWG Comments, Section V(D).

¹⁶⁴ *Id.*

¹⁶⁵ *Id.*

LWG Comments, Figure 7



As LWG concluded, “[e]xamining Year 19 SWACs, EPA’s alternatives are at or near an asymptote of virtually no additional SWAC reduction by about Alternative D, if not Alternative B.”¹⁶⁷

CERCLA requires that EPA make a valid determination that the remedy is cost-effective. The above discussion and the LWG Comments at Section V demonstrate how EPA has failed to make such a determination in the Proposed Plan.

Uncertainty in these analyses does not justify failing to perform them, nor does it warrant selection of a more costly and aggressive alternative without evidence that it performs materially better than a less intensive alternative. To move forward with a prescriptive remedy selection based on Alternative I, EPA’s ROD should demonstrate that EPA has considered uncertainty in initial conditions, has made some estimate of the effectiveness of MNR (and therefore the time frames in which remedial alternatives will reduce risks to comparable levels), has evaluated all remedy elements that reduce risk (including ENR and GAC), and has incorporated reasonable adjustments to clearly flawed costs and construction durations. Further, the ROD should contain some view of effectiveness based on the primary risk of resident fish consumption. Alternatively, EPA’s ROD must offer significant flexibility for additional information to confirm or adjust its remedy approach.

III. Successful Implementation Requires Site Division and Remedy Flexibility

The Site is large, dynamic, and includes an extraordinarily complex array of chemicals, sources, and physical environments. Developing a single FS and Proposed Plan for the entire Site has led to conservative, uniform, and simplifying assumptions that result in many of the legal and

¹⁶⁶ *Id.* at Figure 7.

¹⁶⁷ LWG Comments, Section V(D).

technical deficiencies identified in Section II above and in the LWG comments. If EPA does not correct the major deficiencies before issuing a ROD, or select a less dredge-intensive remedy combined with an adaptive management approach to manage uncertainty, then moving forward with cleanup will require a high degree of flexibility in the remedy design and implementation. This flexibility must include the ability to respond to new information and adjust to the varied conditions around the Site, and may result in EPA concluding that equally protective, less costly cleanup solutions can be implemented successfully within EPA's basic framework using flexible technology assignment decision trees or through future adjustments to the ROD.¹⁶⁸ Dividing the Site into multiple geographic units is an important predicate to addressing the Site's complexity and promoting efficient implementation.

a. Operable Units (OUs) Facilitate Timely Remediation

Separating the Portland Harbor Superfund Site into multiple geographic units (OUs or otherwise) would facilitate a more effective and timely remediation and risk reduction effort. There is significant precedent for this approach, and it is well documented in guidance.

"The cleanup of a site can be divided into a number of [OUs], depending on the complexity of the problems associated with the site. For example, OUs may address geographical portions of a site, specific site problems, or initial phases of an action, or may consist of any set of actions performed over time or any actions that are concurrent but located in different parts of a site."¹⁶⁹ In addition, "[s]ites should generally be remediated in [OUs] when early actions are necessary or appropriate to achieve significant risk reduction quickly, when phased analysis and response is necessary or appropriate given the size or complexity of the site, or to expedite the completion of total site cleanup."¹⁷⁰ Likewise, EPA guidance states that "the cleanup of a site can be divided into a number of [OUs], depending on the complexity of the problems associated with the site" and "[d]ue to the fact that many Superfund sites are complex and have multiple contamination problems or areas, they are generally divided into several [OUs] for the purpose of managing the site-wide response action."¹⁷¹

Given the large areal extent of the Portland Harbor, heterogeneous nature of sediment contamination, and physical characteristics of the Site, breaking the Site into geographic units and implementing the remedies in a systematic manner is consistent with the intent of the above NCP provisions and guidance, and would accomplish several important objectives. Geographic units will allow EPA to identify and evaluate remedy technologies during remedial design by taking into account a more detailed evaluation and engineering assessments of existing information, new baseline conditions, the physical characteristics of the sediments, the hydrodynamic conditions, and the types of exposures mitigated (e.g., high concentration areas) across different geographies. This approach would also facilitate expedited remediation in high-priority areas or areas where conditions are well-defined to quickly reduce risk and control sources of contamination. A phased remediation would enable a period of monitoring to evaluate the effectiveness of the remedial actions, consistent with EPA guidance.

Furthermore, any perceived disadvantages of dividing the Site into geographic units can be managed. The concept of geographic units simply expands upon the approach EPA has already identified in the Proposed Plan to optimize the remedy in certain SDUs of the Site. Dividing the Site into geographic units can be accomplished in a way to ensure that all areas of

¹⁶⁸ See Preparing Proposed Plan Guidance.

¹⁶⁹ 40 C.F.R. § 307.14; 40 C.F.R. § 35.6015.

¹⁷⁰ 40 C.F.R. § 300.430.

¹⁷¹ Preparing Proposed Plan Guidance at 6-8.

Portland Harbor are addressed and will continue to be addressed throughout the CERCLA remediation process. Furthermore, separating the Site could encourage parties to proceed more quickly toward remedy implementation, which is in the best interest of all stakeholders involved. Geographic units will also not preclude the realization of cost efficiencies, as staging facilities and equipment can be shared as remedy construction shifts from one unit to another.

Other sediment Superfund sites provide precedent for using OUs to address similar issues of site complexity and remedy implementation. For example, the Fox River site was divided into five OUs on the basis of physical features and historical data, and the Housatonic and Hudson Rivers have been divided into units or work areas for phased approaches to remediation. Similarly, the Harbor Island and Wyckoff-Eagle Harbor NPL sites in Region 10 were divided into separate in-water OUs. Harbor Island was split into multiple OUs because EPA determined it "could be managed more efficiently," and Wyckoff-Eagle Harbor was divided into OUs because of differences in "environmental media, sources of contamination, public accessibility, enforcement strategies, and environmental risks in different areas of the . . . site."¹⁷²

Overall, dividing the Site into geographic units can facilitate management of the Site by allowing for a cost effective, manageable, and implementable remedy. The LWG comments include a conceptual framework for how OUs could be used to help achieve these goals.¹⁷³

b. The ROD Will Require Remedy Flexibility

Practically speaking, EPA has a number of options for addressing the technical and legal deficiencies discussed above. The clearest option would be to correct the major deficiencies, and select a remedy that is justified by scientifically defensible and legally sufficient analysis. However, if EPA declines to do so, then having a chance at timely, successful remedy implementation will require EPA to incorporate significant flexibility into its ROD.

i. Less dredge-intensive remedy selection with an adaptive management approach to performance

One option would be for EPA to acknowledge that significant uncertainties and gaps remain in the foundational analyses of critical components such as background levels, initial conditions, and long-term effectiveness in reducing risks. Then, EPA could select an alternative that addresses the highest contaminant concentrations as an initial remedy, using an adaptive management approach to monitor and adjust active remediation following implementation of the initial action if it was determined that additional work is needed to achieve protectiveness.¹⁷⁴

This approach is supported by EPA guidance, which recognizes that contaminated sediment sites are different from and more complex than more "typical" Superfund sites. The complexities include: large geographic extent; multiple and legacy sources of contamination; dynamic and evolving sediment systems; difficult engineering challenges in aquatic environments; and high costs and lengthy time frames for remedy implementation. As a result of these and other considerations, and intending to promote scientifically sound and nationally consistent risk management decisions at sediment sites, EPA published guidance that

¹⁷² U.S. Env'tl. Prot. Agency, *Record of Decision, Harbor Island Soil and Groundwater* at 6 (Sept. 1993); U.S. Env'tl. Prot. Agency, *Record of Decision, Wyckoff/Eagle Harbor, WA* at 15 (Sept. 1992).

¹⁷³ See LWG Comments, Section VI.

¹⁷⁴ Although the Port believes that such a less intensive remedy would meet the NCP criteria based on the administrative record and addressing the legal and technical deficiencies of EPA's analysis, an adaptive management approach would permit adjustment for additional work to the extent such protectiveness was not achieved.

articulates 11 Risk Management Principles¹⁷⁵, as well as guidance for project managers making remedial decisions for contaminated sediment sites.¹⁷⁶

The Risk Management Principles advocate for the use of an iterative approach in a risk-based framework. EPA explains that “an iterative approach is defined broadly to include approaches which incorporate testing of hypotheses and conclusions and foster re-evaluation of site assumptions as new information is gathered.”¹⁷⁷ EPA goes on to say that “[a]t complex sediment sites, site managers should consider the benefits of phasing the remediation”; and that in some cases “it may be appropriate to take an interim action to control a source, or remove or cap a hot spot, followed by a period of monitoring in order to evaluate the effectiveness of these interim actions before addressing less contaminated areas.”¹⁷⁸

The Sediment Guidance similarly provides that “[p]roject managers are encouraged to use an adaptive management approach, especially at complex sediment sites to provide additional certainty of information to support decisions”; this “means testing of hypotheses and conclusions and reevaluating site assumptions as new information is gathered.”¹⁷⁹ An example of an adaptive management approach outlined in the Sediment Guidance is gathering and evaluating multiple data sets or pilot testing to determine the effectiveness of various remedial technologies at a site.¹⁸⁰ The Sediment Guidance also promotes phasing in both remedy selection and implementation where, for example, contaminant fate and transport processes are not well understood, the remedy has significant implementation uncertainties, or the effectiveness of source control is in doubt.¹⁸¹ The Sediment Guidance notes that “[h]igh remedy costs, the lack of available services and/or equipment, and uncertainties about the potential effectiveness or the risks of implementing the preferred . . . approach, can also lead to a decision to phase the cleanup.”¹⁸² An adaptive approach does not lead to a “do nothing” or “wait and see” tactic.¹⁸³ Instead, it promotes smart decision making and implementation, which is informed by information as it is gathered and understood to achieve an efficient and effective remedial-solution.

To be clear, an adaptive management approach would make implementation *less* successful, not more successful, if applied to EPA’s selection of Alternative I. The point is that EPA has not adequately supported its conclusion that Alternative I is better suited to achieve protectiveness, meet ARARs, or reduce risks in a timely fashion than less intensive alternatives. An adaptive management approach could encourage parties to proceed more quickly and learn from empirical information about both the remedy’s effectiveness and the achievability of EPA’s background-based remedial goals, and then adjust the remedy approach as needed.

ii. Flexible Technology Assignment Flowcharts, with Incorporation of
Material New Information

If EPA moves forward with Alternative I without correcting the major deficiencies outlined in this Appendix, then successful remedy performance will require EPA’s ROD to apply the principles

¹⁷⁵ Risk Management Principles.

¹⁷⁶ Sediment Guidance.

¹⁷⁷ Risk Management Principles.

¹⁷⁸ *Id.* at 6.

¹⁷⁹ Sediment Guidance, at 2-22.

¹⁸⁰ *Id.* at 2-22.

¹⁸¹ *Id.* at 2-21–2-22.

¹⁸² *Id.* at 2-22.

¹⁸³ See Risk Management Principles, at 6.

of flexibility discussed above in both remedial design and implementation, including remaining open to post-ROD adjustments to the remedy approach.

In the ROD, EPA should modify its decision tree framework to allow its remedy to stay responsive to up-to-date, site-specific data collected and analyzed after the ROD. Appendix A describes adjustments that allow a Swan Island-specific version of EPA's technology assignment charts to be responsive to information about site-specific conditions—whether it be site-specific information presented in public comment that EPA did not previously consider, new information gathered after the ROD, or pilot studies conducted in pre-remedial design. Going a step further, the LWG proposes a remedial technology assignment decision tree for harbor-wide application that would replace EPA's decision tree approach.¹⁸⁴ Its adoption in the ROD would significantly improve the ability of EPA's remedy to accommodate site-specific conditions into remedy technology selection and design. By using these flexible decision-making frameworks, EPA can achieve certainty that important effectiveness and permanence considerations will determine remedy technology selection and design without forcing an overly conservative, prescriptive approach due to uncertainty.

In some cases, new information gathered after the ROD may shed new light on the appropriateness of conclusions reflected in the ROD, and may require EPA to remain open to future administrative adjustments. For example, if EPA moves forward with its background-based cleanup goal for PCBs of 9 ppb harbor-wide, pilot studies at Swan Island may reveal conclusively that the unique hydrodynamic conditions of Swan Island make achieving that goal impossible.

To promote timely progress toward implication, should EPA select Alternative I in the ROD, EPA should adopt the modified technology assignment flowcharts and make a statement of its commitment to incorporate meaningful new information into site-specific remedy approaches. A statement such as the following would be consistent with EPA guidance and signal EPA's intention:

As is the case with all complex sediment sites, even after extensive study and the selection of a final remedy, there remains significant uncertainty concerning the physical, biological, and chemical conditions of the Site. As a result, EPA guidance recognizes that iterative, risk-based frameworks must be a critical component of designing and implementing the Selected Remedy. EPA's objective is to use current and accurate information regarding site conditions, including information developed during remedial design or implementation of the remedy, to further refine the Selected Remedy. This information will inform the effectiveness of the remedial approaches and technologies used, and the responses of environmental receptors to changes in contaminant concentrations, ecological conditions, and habitat. Results from remedial design (including baseline monitoring sampling) will be used to refine delineation of areas to be remediated within each Sediment Decision Unit (SDU) and varying remediation technologies to be applied, and to inform source control activities. This approach is consistent with EPA guidance, *Contaminated Sediment Remediation Guidance for*

¹⁸⁴ LWG Comments, Section IV(A) and Figure 12.

Hazardous Waste Site, OSWER Dir 9355.0-85, 2-22 (USEPA 12/2005), which encourages the use of adaptive management to guide the collection of information to resolve uncertainties so that the most effective cleanup is achieved cost effectively.

c. Risk management and flexibility can allow EPA's basic framework to achieve equally protective and implementable outcomes at Swan Island Lagoon and Terminal 4

The Port identifies significant technical and legal deficiencies in EPA's approach to Swan Island SDU and Terminal 4, but also provides concrete recommendations for adjustments that sufficiently improve risk characterization, risk management, and flexibility to allow EPA to reach an implementable remedy outcome based on additional site-specific analysis during pre-remedial design. These are concrete examples of how improved flexibility and attention to site-specific conditions can help EPA move past the deficiencies in its Proposed Plan.

i. Swan Island Lagoon

Swan Island Lagoon is a blind-end industrial slip and berthing area located outside of the main channel of the Willamette River. Because the Lagoon is off-channel and enclosed, it is a hydrologically quiescent environment where sediments are physically and chemically stable. An alternative approach is appropriate for this area for the reasons described in Appendix A. They include that:

- areas appropriate for in-place remedial technologies (e.g., capping and ENR) are larger than EPA assumed when key site-specific information and conditions (e.g., sediment stability, FMD and navigation depth needs) in the Lagoon are included and considered;
- comparative analysis shows that the optimized alternative remedy can achieve a similar level of risk reduction can be achieved by applying a tailored mix of remedial technologies within areas identified for active remediation;
- more rapid risk reduction can be achieved through such quicker remedial actions, while minimizing the short-term impacts to the environment and community that would otherwise result from a dredge-intensive remedy;
- realistic, site specific factors, such as ubiquitous contaminant contributions found in, around, and upstream of a hydrologically quiescent waterway like Swan Island Lagoon cannot be controlled by a sediment remedy itself; and
- high costs and significant implementation challenges of EPA's proposed alternative should be carefully considered.

These are exactly the type of reasons contemplated by the Risk Management Principles and Sediment Guidance that demand the use of a flexible approach to refine the remedial solution. Indeed, "[a]t sites with multiple . . . sections of water bodies with differing characteristics or uses, or differing levels of contamination, . . . alternatives that combine a variety of approaches are frequently the most promising."¹⁸⁵

For these reasons, and those described further in the Port's comments and Appendix A, EPA needs to make the following adjustments in its ROD that will give its remedy approach for Swan Island more flexibility:

¹⁸⁵ Sediment Guidance at 3-2.

- (1) Incorporate up-to-date information such as FMD designation and required navigational depths for the Swan Island area and acknowledge the existing analysis such as the stable nature of sediments;
- (2) adjust the technology assignment flowcharts to enable greater application of in-place remedy technologies in this uniquely stable sediment environment, if warranted by site-specific investigation; and
- (3) maintain flexibility in the remedial design process based on a series of site-specific investigations that will further inform and better manage key assumptions and uncertainties identified by EPA.

The conceptual remedy that would result from applying these adjustments to the EPA framework would achieve equivalent risk reduction at significantly lower cost and would be compatible with current and future uses of the Lagoon.

ii. Terminal 4

Terminal 4 is a secured marine facility, and similar to Swan Island Lagoon, is a quiescent, off-channel area, where the majority of sediments are physically and chemically stable outside of active berthing areas. Terminal 4 was also the subject of a Port-led early removal-action, which significantly reduced risk levels. Any remedy for the Site should build on this successful early action.

An alternative approach at Terminal 4 is necessary for the reasons given in Appendix B and summarized here:

First, the Port's comments demonstrate that EPA's human direct contact exposure scenario (i.e., high-frequency fishing and direct sediment-exposure) is unsubstantiated.¹⁸⁶ Long-term safety and security considerations prevent meaningful amounts of fishing in Terminal 4. EPA's remedy assumes 260 days of fishing per year, which is an impossible assumption based on the facts set forth in Appendix B. To the extent EPA determines that additional information is needed to support the conclusion that direct sediment-exposure should not be a remedy driver, the ROD should enable the Port to demonstrate these facts to EPA in remedial design. This would be consistent with EPA's guidance, which promotes "testing of hypotheses and conclusions and reevaluating site assumptions as new information is gathered."¹⁸⁷

Second, cleanup in Terminal 4 should address the true risk driver—benthic risk. EPA's modifications to the previously developed benthic risk analysis make it unsuitable for predicting toxicity. To identify active remedy areas, it is necessary to use a supported analysis to guide site-specific toxicity testing in remedial design consistent with the Comprehensive Benthic Risk Approach in the approved baseline ecological risk assessment.

Third, EPA should make it clear that the ROD will allow flexibility to modify remedial technology assignments and footprints during remedial design to address site risk more efficiently, to better accommodate site uses and constraints, and to incorporate important pre-remedial design investigation results.

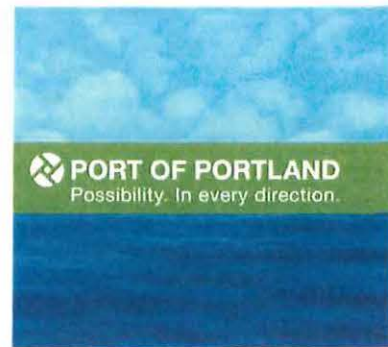
¹⁸⁶ See Appendix B.

¹⁸⁷ Sediment Guidance, at 2-22.

APPENDIX D1

June 22, 2016

Dennis McLerran, Administrator
Environmental Protection Agency, Region 10
1200 6th Avenue
Seattle, WA 98101



Dear Dennis:

The Port of Portland (Port) welcomes the arrival of a significant milestone in the cleanup of Portland Harbor—the Environmental Protection Agency's (EPA's) release of its Proposed Plan and Draft Final Feasibility Study (FS). This milestone represents years of hard work by EPA, the Oregon Department of Environmental Quality, the Port, and other members of the Lower Willamette Group (LWG), who signed on to help EPA study the risks posed by contamination in the Harbor and develop options for cleanup.

The Port is committed to a cleanup of Portland Harbor that protects the health of Portlanders and our environment and to finding the most cost-effective way to achieve it. After studying the river, and doing our own early cleanup work, we are ready for the next step.

However, we are concerned that EPA's approach to the FS does not provide an appropriate foundation for selection of a protective, cost-effective and implementable remedy. The Port has expressed its concerns through LWG comments to EPA, LWG comments to the National Remedy Review Board, and during various meetings with EPA.

The FS is intended to provide a strong analytic foundation for remedy selection. Laws, regulations, and EPA guidance require the FS to provide credible, quantitative information and analysis about the relative effectiveness and cost of different options for meeting cleanup goals. Those cleanup goals must be achievable and correspond to a realistic assessment of risk at the site. The Port urges EPA to find a way to work through the following key areas of concern with the FS:

- **Weighing the Trade-Offs.** Cleanup cost estimates in the FS are unfairly optimistic, and there is no credible, quantitative explanation of how EPA's preferred cleanup option reaches cleanup targets in a substantially shorter time than more cost-effective cleanup options. As a result, the FS does not accurately represent or adequately inform the public about the true costs and benefits of different cleanup options. Rigorous attention to cost-benefit trade-offs is crucial at a time when the City and region are facing many critical affordability issues.
- **Setting Realistic Goals.** The FS portrays the risks from contamination in Portland Harbor as more significant than the approved risk assessments and sets cleanup goals that a sediment-only remedy cannot achieve at the site. This urban waterway is subject to ongoing watershed sources of pollution that a Superfund sediment cleanup cannot address. EPA should set cleanup levels that are technically practicable based on site-

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June 22, 2016

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specific considerations and that can be achieved by the sediment remedy in a reasonable time frame.

- **Retaining Flexibility.** The FS appears to lack the flexibility to accommodate significant remedy adjustments and design choices that may be appropriate after additional, necessary data gathering and analysis. Flexibility is particularly important given the uncertainty in EPA's analysis of remedy effectiveness and achievability. Rather than prescriptively requiring a more aggressive remedy up front, EPA should be open to phased, adaptive approaches that may be able to achieve the same cleanup targets more cost-effectively through careful attention to site-specific conditions.

These key shortcomings, described in more detail in a brief attachment to this letter, make the FS deficient as a basis for remedy selection. The FS also falls short in its vision for remedy implementation. It does not provide a breakdown of remedy costs by subareas of the Harbor, and it barely hints at a willingness to divide the site into separate administrative units to facilitate cleanup, closure and settlement.

EPA did not change its approach when the LWG identified these concerns in detailed technical comments during the FS development process. The Port, as a member of the LWG, stands behind the work performed by the LWG pursuant to the Administrative Settlement Agreement and Order on Consent and continues to share many of the key concerns with the FS expressed in a dispute to be filed by other members of the LWG today.

In comments on the Proposed Plan, the Port intends to offer a detailed explanation of its most important concerns and constructive paths forward to cleanup. The Port expects that EPA will give careful consideration to all significant issues raised, both through dispute and comments.

Portland deserves a cleanup approach that transparently defines cleanup costs and the public health and environmental benefits to be achieved. EPA has the chance to adjust the FS, improve the flexibility of the remedy decision, and provide a vision for cleanup that allows timely execution of agreements to implement remedial actions to protect the health of Portlanders and our environment.

Sincerely,



Curtis Robinhold
Deputy Executive Director

cc: Cami Grandinetti, EPA Region 10
Jim Woolford, EPA HQ

Attachment

Attachment

Port of Portland June 22, 2016 Letter to Dennis McLerran, Administrator, EPA Region 10
Key Issues with EPA Draft Final Feasibility Study

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), the National Contingency Plan (NCP), and EPA guidance contain requirements for carrying out site Feasibility Studies. EPA's Draft Final Feasibility Study (FS) does not satisfy certain key requirements. Areas of concern, which will be described more fully in Proposed Plan comments, include the following:

1. Inadequate analysis of long-term effectiveness, short-term effectiveness, cost and implementability, leading to incomplete evaluation of alternatives

EPA's FS does not quantify or inaccurately quantifies long-term effectiveness, short-term effectiveness, cost, and implementability—four of the nine criteria that the NCP requires EPA to consider when weighing cleanup alternatives.¹ As a result, it is very difficult to identify a link between costs of the remedial actions and the likely public health and environmental risk benefit to be achieved. Key examples and consequences include:

- Time to achieve goals. The FS does not evaluate how long it will take alternatives to achieve cleanup levels after dredging and capping are completed.² Thus, EPA provides no credible explanation of how its proposed remedy achieves risk reduction or attains cleanup goals in a substantially shorter time than other alternatives. Without a reasonable, quantitative basis to compare time frames in which cleanup goals will be attained, trade-offs cannot be evaluated as required under the NCP.
- Effectiveness of enhanced natural recovery. EPA correctly identifies enhanced natural recovery (ENR) as an appropriate technology for the unique conditions within Swan Island Lagoon.³ Yet, in a reversal from EPA's prior drafts, it appears that EPA's Draft Final FS does not attempt to measure *any* quantitative effect of ENR on reducing risk.⁴ A quantitative evaluation of risk reduction from ENR would demonstrate that there is an equally protective, more cost-effective cleanup approach available for Swan Island.
- Inaccurate cost estimates. The FS uses overly optimistic, inaccurate cost estimates. For example, EPA's assumptions for contingency factor, project management and design, and discount rate are skewed low. EPA guidance recommends a contingency factor of 20 to 45 percent; EPA chose 20 percent, the lowest number in the range, despite Portland Harbor's complexities.⁵ EPA selected lower percentages than its guidance recommends for project and construction management and remedial design.⁶ Further, EPA used a discount rate of 7 percent, which is out of step with the 2.3 percent used

¹ 40 C.F.R. § 300.430(e)(9)(iii)(C),(E)-(G).

² See Portland Harbor Feasibility Study, U.S. Environmental Protection Agency and CDM Smith (2016) (hereafter, "FS"), Sec. 4.1.2.

³ FS, Sec. 3.5.1 and Appendix D6.

⁴ See *id.* and FS, Appendix J.

⁵ See FS Appendix G, Attachment A, pages 8-9 and Table CS-E, page 3; *Developing and Documenting Cost Estimates During the Feasibility Study* (EPA 2000), section 5.4 and Exhibit 5-6.

⁶ *Id.*

recently in EPA Region 10.⁷ The consequence is to skew cost estimates low and make highly dredging-intensive remedies appear more cost-effective relative to other alternatives.

- Optimistic implementation assumptions. The FS makes a number of aggressive assumptions as to how the cleanup will be implemented. For example, EPA optimistically assumes dredging and capping can occur 24 hours per day, 6 days per week, and predicts higher dredging production rates than have been observed with similar sediment cleanup actions in the Willamette and Columbia Rivers. As a result, the FS greatly underestimates implementation time, which in turn leads to inaccurate costs and distorted short- and long-term effectiveness analyses that favor alternatives with more capping and dredging.
2. **Sets goals that are unachievable in an urban waterway, inconsistent with the baseline risk assessments, and not based on appropriate risk management principles**

EPA's contaminants of concern, preliminary remediation goals, and remedial action objectives (RAOs) are inconsistent in a number of ways with its baseline risk assessments. Additionally, EPA has not followed a clear risk management framework, which means the proposed RAOs are not likely to be achieved by a sediment remedy in a reasonable time frame. Key examples and consequences include:

- Unachievable goals. EPA's guidance recommends that cleanup objectives "should reflect objectives that are achievable from the site cleanup."⁸ However, EPA sets cleanup goals for Portland Harbor based on an inaccurate assessment of what a sediment cleanup can achieve, given that upstream flow continues to carry contaminated sediments into the Harbor. EPA should use a reasonable range for background concentrations and equilibrium values, and should use site-specific achievability for each Sediment Decision Unit instead of a Harbor-wide average to set cleanup goals.
- Inconsistency with risk assessments. EPA's FS reflects two major inconsistencies with its previously approved risk assessments for Portland Harbor.
 - Baseline Risk. EPA apparently used a different method for estimating baseline risk for the FS compared to the baseline risk assessments.⁹ As a result, risk estimates for some parts of the river are much higher than what is presented in the approved risk assessments. This last-minute change may have a number of significant implications, including for designating areas that EPA treats as "principal threat waste."
 - Benthic risk. EPA also changed its approach to analyzing risk to benthic organisms. The FS arbitrarily concludes that alternatives do not meet its interim risk target unless they remediate 50 percent of the area indicated in EPA's new benthic risk maps. This leads to an inadequately supported conclusion that Alternatives B and D may not be protective.¹⁰

⁷ See FS Appendix G, Attachment A, pages 9-10; Final Feasibility Study, Lower Duwamish Waterway Group (October 31, 2012), Appendix I, page I-5.

⁸ Contaminated Sediment Remediation Guidance for Hazardous Waste Sites, §2.4.1 (OSWER 9355.0-85, December 2005) ("EPA 2005")

⁹ See FS, Appendices I and J.

¹⁰ See FS, pages ES-15, 4-8, 4-88-4-89, 4-98.

- Lack of risk management perspective. EPA does not follow its recommended risk management approaches.¹¹ EPA has consistently overestimated Harbor-wide risk and required cleanup that does not meaningfully reduce risk. In addition, EPA does not analyze the likelihood of exposures actually occurring, based on site-specific conditions.
- Inappropriate principal threat waste designation. EPA has designated principal threat waste (PTW) over large geographic areas with relatively low concentrations of contaminants. According to the NCP and EPA guidance, PTW is highly toxic or highly mobile waste *that cannot be reliably contained*.¹² The FS fails to explain how sediments in these large areas are highly mobile or highly toxic *and* cannot be reliably contained. For example, PCB concentrations of 200 part per billion (ppb) can be reliably contained; in fact, EPA analysis in the FS shows that PCBs can be reliably contained at any concentrations occurring in Portland Harbor.¹³ In addition, the "highly toxic" designation is intended to be measured based on direct exposure, not the indirect exposure pathway for PCBs that EPA identifies.¹⁴ Overall, EPA's approach to PTW at Portland Harbor is significantly out of step with EPA's approach at many other sediment sites.¹⁵

3. **Lack of flexibility to accommodate equally protective, more cost-effective site-specific remedy design**

EPA can do more to accommodate site-specific remedy selection and design to generate equally protective, more cost-effective results.

- Iterative, risk-based approaches. EPA's FS expresses little flexibility to accommodate different approaches to cleanup, considering site-specific conditions and risk management opportunities. EPA should evaluate adaptive management and contingent remedies, which are an appropriate response to the significant uncertainty in EPA's analysis of remedy effectiveness and achievability. These approaches can bring down initial barriers to cleanup and reach equally protective performance goals. They are supported by EPA guidance, but not considered in EPA's FS and Proposed Plan for Portland Harbor.¹⁶
- Flexible decision trees. EPA further restricts cleanup design with prescriptive decision trees. By applying the same decision trees to environments across the Harbor, EPA does not allow for meaningful comparison of the performance of various technologies based on particular site conditions. Setting prescriptive requirements in the FS will prevent later evaluation of the most appropriate technology assignments and configurations for remedial design at specific sites within the Harbor. If EPA continues using decision trees in the FS, it should incorporate criteria more suited to remedial design.

¹¹ See, e.g., EPA 2005, § 7.1.

¹² A Guide to Principal Threat and Low Level Wastes. Office of Solid Waste and Emergency Response. Superfund Publication 9380.03-06FS. Washington, D.C. November 1991. ("EPA 1991")

¹³ FS, Table 3.2-2.

¹⁴ See EPA 1991.

¹⁵ See Letter from Lower Willamette Group to Amy Legare (Chair, National Remedy Review Board), October 19, 2015, Table 4.

¹⁶ EPA 2005, Section 3: "[P]roject managers should keep in mind that flexibility is frequently important in the feasibility study process at sediment sites. Iterative or adaptive approaches to site management are likely to be appropriate at these sites."

APPENDIX D2

THE LOCAL AND REGIONAL ECONOMIC IMPACTS OF PORTLAND WORKING HARBOR, FISCAL YEAR, 2015



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January 25, 2016

Economic Impacts of Portland Working Harbor

Portland's Working Harbor (referred to as PWH) is the deep water shipping channel and surrounding marine, commercial, industrial and transportation infrastructure from about the Broadway Bridge on the Willamette River (RM 11.65) to Terminal 6 on the Columbia River. The PWH includes public and private marine terminals, industrial parks, and other commercial and warehousing businesses. Martin Associates was retained by the Port of Portland to prepare a study that presents the economic impacts of the terminals and firms located within PWH.

As background, Martin Associates recently completed two related studies for the Port of Portland that were reported in The Local and Regional Economic Impacts of the Port of Portland, 2015 (the "Port of Portland Economic Impact Study"):¹

- (1) The Economic Impacts of the Portland Harbor, 2015. This study with slightly different geography than the PWH provided the economic impacts created by marine cargo and vessel activity handled at and related to marine terminals located in the Portland Harbor, but did not include economic impacts of other businesses located within Portland Harbor. The study focused on the public marine terminals owned by the Port of Portland and private marine terminals located within the Harbor boundaries as defined by the U.S. Army Corps of Engineers. The Port of Portland's public marine terminals include Terminal 6, which is the primary ocean container terminal on the Columbia River; Terminal 2, which handles break bulk cargoes and steel; Terminal 4, which handles bulk products, as well as break bulk cargoes and automobiles; and Terminal 5, which handles grain and mineral bulks. Automobiles and break bulk are also handled at Terminal 6. Private marine terminals within the Portland Harbor handle grain, petroleum products and dry bulk cargoes such as cement, alumina, sand and gravel and limestone. In fiscal year 2015, these public and private marine terminals in the Portland Harbor handled nearly 21.3 million tons of cargo for exporters and importers located within the metropolitan region, the state of Oregon, as well as throughout the Pacific Northwest and the United States.
- (2) The Economic Impact of the Port of Portland Developed Industrial Properties, Fiscal Year 2015. This study included the economic impacts of the tenants located in the industrial parks developed by the Port of Portland at Swan Island, Rivergate, Troutdale Industrial Park and Portland International Center. The study excluded marine terminals, airport properties and other Port-owned properties not contained in these parks. Two

¹ The Local and Regional Economic Impacts of the Port of Portland, 2015, prepared for the Port of Portland, 2016 by Martin Associates. This report summarizes three separate studies: The Economic Impacts of the Portland Harbor; The Economic Impacts of Port of Portland Developed Industrial Parks; and the Economic Impacts of Portland International Airport and Aviation Activity Hillsboro and Troutdale.

of these industrial parks—Swan Island and Rivergate—are located within Portland Harbor.

Martin Associates was retained to expand the Port of Portland Economic Impact Study to identify the total economic impacts of the companies located within Portland Harbor, regardless of whether the uses were water dependent or whether the firms are located within the Port's Rivergate and Swan Island industrial and business parks. This expanded geography created what is identified as the PWH described in this study.

The 2015 Economic Impact of the Portland Harbor only included the economic impacts of the service providers and marine terminals and tenants that were dependent on the use of the marine terminals to ship and receive cargo. For those tenants and service providers that were only partially dependent upon the use of the marine terminals, employment was adjusted down to only reflect the portion that is dependent on the use of the terminals. Employment with the firms that were not directly dependent on shipping and receiving cargo via the terminals was not included in the economic impact analysis.

Similarly, the economic impacts measured for the Port of Portland developed industrial parks only include the impacts of the tenants of these parks, particularly the Rivergate and Swan Island industrial parks, and not the economic impacts of firms located within the harbor as a whole. Therefore, the marine cargo and real estate tenant economic impacts measured in the Port of Portland Economic Impact Study are a subset of the total economic impacts of the Portland Working Harbor.²

To measure the total impacts of the Portland Working Harbor, Martin Associates was provided access to an Oregon Employment Department (OED) data base by Port of Portland. This confidential data base was used to identify those firms not included in the Port of Portland Harbor Economic Impact Study, as well as the employment of the firms that were only partially included in the impact analysis based on the degree of dependency on shipping and receiving cargo via the public and private marine terminals. Similarly, those non-maritime dependent firms located within the geographical boundaries of the PWH, but not tenants of the Port of Portland's Rivergate and Swan Island industrial and business parks were identified from the OED data base. The OED data base includes employment and average salary for each firm. The data in the OED data base was used to match the employment data measured for each firm included in the Port of Portland Economic Impact Study with that firm data in the OED data base, so as to identify employment that was not dependent upon the cargo activity at the private and public marine terminals.³ In

² The impacts of PDX and the general aviation airports and the tenants of the Portland International Center and the Troutdale Industrial park are not included in the Portland Working Harbor.

³ The employment data used in the Port of Portland Economic Impact analysis of the Portland Harbor is based on detailed survey data collected by Martin Associates, and the jobs are expressed in terms of full-time employees. The

addition, the OED data base was used to identify non-maritime cargo related firms that were not tenants of the Rivergate and Swan Island industrial and business parks.

The economic impacts measured are:

- Employment impact;
- Personal earnings impact;
- Business revenue impact; and
- Tax impact.

Direct jobs are those jobs held by employees of a particular firm, and are measured in terms of full-time equivalent workers. The employment is based on a survey of nearly 700 firms conducted by Martin Associates as part of the Local and Regional Economic Impacts of the Port of Portland, 2015, and combined with the firm-specific employment data provided from the OED data base for the firms not included in the Port of Portland economic impact analysis but who are located in the Portland Working Harbor.

Those directly employed by firms in a given industry receive wages and salaries. A portion of the wages and salaries is saved; another portion is used to pay personal taxes, while a final portion is used to purchase goods and services. A percentage of these purchases are made in the Portland metropolitan area, while some consumption purchases are made outside the area. These consumption purchases, in turn, generate additional jobs in those firms supplying the goods and services. The **induced jobs** measured in this study are only those generated in the Portland metropolitan area.

Jobs, which are created due to the purchases by firms, not individuals, are classified as **indirect jobs**. These jobs are estimated based on the local purchases made by the firms located within the Portland Working Harbor.

The **income impact** consists of the level of wage and salary earnings associated with the jobs created by the firms within the Portland Working Harbor, and is adjusted to reflect re-spending throughout the economy. The personal income impact is, for the most part, based on salary and annual earnings data provided from the survey conducted by Martin Associates. As described above, individuals directly employed by a firm use a portion of their income to purchase goods and services. A portion of these purchases is made from firms located in the Portland area, while another portion is used for out-of-region purchases. Re-spending of income within a geographical region is measured by an income multiplier. The size of the multiplier varies by region depending

OED data is number of jobs. However, budget limitations did not permit a detailed survey of all firms located in the Portland Working Harbor.

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on the proportion of in-region goods and services purchased by individuals. The higher this percentage is, the lower the income leakage out-of-region.⁴

The **revenue impact** is the measure of direct business revenue received by firms located in the Portland Working Harbor.

The **state, county and local tax revenues** are generated by economic maritime activity at the marine terminals and by the activity of the real estate tenants of the Port of Portland Business and Industrial Parks and other firms located within the Portland Working Harbor.

The combined economic impacts of the Portland Working Harbor are presented in Exhibit I.

Exhibit I
Economic Impact of the Portland Working Harbor

TOTAL IMPACTS	
JOBS	
Direct	29,490
Induced	19,152
Indirect	<u>16,339</u>
TOTAL	64,981
PERSONAL INCOME (\$1,000)	
Direct	\$1,508,635
Re-Spending/Local Consumption	\$2,000,592
Indirect	<u>\$706,929</u>
TOTAL	\$4,216,156
BUSINESS REVENUE (\$1,000)	\$12,641,541
LOCAL PURCHASES (\$1,000)	\$1,832,374
STATE/LOCAL TAXES (\$1,000)	\$413,395

⁴ It is to be noted that different income multipliers are used to estimate the induced job impacts and the re-spending and consumption impacts for seaport activity and real estate activity. The income multipliers, as estimated for Martin Associates by the U.S. Bureau of Economic Analysis for the Portland regional economy, reflect the level of salary associated with each industry group, as well as the leakages of income from the Portland economy for the specific industry sector. Because of the higher direct wages and salaries associated with seaport activity, the direct income multiplier used to measure the impacts of the seaport activity is higher than the direct income multiplier associated with the real estate tenants.

In summary, 64,981 direct, induced and indirect jobs are supported by the Portland Working Harbor:

- 29,490 jobs are directly created by the firms located within the Portland Working Harbor.
- As the result of local purchases by the 29,490 directly employed workers, an additional 19,152 induced jobs are supported in the local economy to provide goods and services to those directly employed.
- 16,339 indirect jobs are also supported in the local economy as the result of the local purchases of goods and services by the firms located within the Portland Working Harbor.

Businesses located within the Portland Working Harbor received \$12.6 billion of direct business revenue. The \$12.6 billion of revenue received by the businesses providing the services in the Portland Harbor does not include the value of the cargo moving over the marine terminals, since the value of the cargo is determined by the demand for the cargo, not the use of the marine terminals.

The business activity located within the Portland Working Harbor also created \$4.2 billion of direct, induced and indirect personal wage and salary income and local consumption expenditures for Portland metropolitan residents. The consumption expenditures are a part of the direct multiplier effect, and measure the local consumption expenditures by those directly employed. The consumption expenditures support the induced jobs. The 29,490 direct job holders received \$1.5 billion of direct wage and salary income, for an average salary of \$51,158.⁵

A total of \$413.4 million of state and local tax revenue was generated by activity in the Portland Working Harbor in fiscal year 2015.

⁵ The re-spending and local consumption impact cannot be divided by induced jobs to estimate average induced salary, since local consumption expenditures are counted in the re-spending effect. This would overstate the average induced wage and salary per induced job.

